SCIENTIFIC AMERICAN

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A POPULAR ILLUSTRATED WEEKLY OF THE WORLD'S PROGRESS

Vol. CI.—No. 25.]
ESTABLISHED 1845.]

NEW YORK, DECEMBER 18, 1909.

[10 CENTS A COPY
[$3.00 A YEAR.

If piled up in Madison Square the crops of this year would completely dwarf the Metropolitan tower.

THE ENORMOUS CROPS OF 1909.—[See page 466.]

SCIENTIFIC AMERICAN

ESTABLISHED 1845

MUNN & CO., Inc., - Editors and Proprietors

Published Weekly at
No. 361 Broadway, New York

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361 Broadway, New York.
FREDERICK CONVERSE BEACH, *Sec'y and Treas.*
361 Broadway, New York.

TERMS TO SUBSCRIBERS.

One copy, one year, for the United States or Mexico $3.00
One copy, one year, for Canada 3.75
One copy, one year, to any foreign country, postage prepaid, 18s. 6d. 4.50

THE SCIENTIFIC AMERICAN PUBLICATIONS.

Scientific American (established 1845) .... $3.00 a year
Scientific American Supplement (established 1876).............. 5.00 "
American Homes and Gardens .... 3.00 "
Scientific American Export Edition (established 1878). .... 3.00 "

The combined subscription rates and rates to foreign countries, including Canada, will be furnished upon application.

Remit by postal or express money order, or by bank draft or check.
MUNN & CO., Inc., 361 Broadway, New York.

NEW YORK, SATURDAY, DECEMBER 18th, 1909.

The Editor is always glad to receive for examination illustrated articles on subjects of timely interest. If the photographs are *sharp*, the articles *short*, and the facts *authentic*, the contributions will receive special attention. Accepted articles will be paid for at regular space rates.

A REVERSION TO TYPE.

The old American eight-wheel passenger locomotive, with its flexible wheel base and comparatively high center of gravity, was admirably adapted to the tracks on which it ran. When, a few years ago, electric traction was applied to our steam railroads, the designers of the electric motors made the mistake of ignoring altogether the steam locomotive, and basing their designs upon electric street car practice. Consequently, the first electric locomotives for this work were, in respect of their driving mechanism, nothing more nor less than exaggerated trolley cars, with the characteristic rigid wheel base and a low center of gravity.

When the plans of the electric locomotives for the New York Central and New Haven railroads were made public, the SCIENTIFIC AMERICAN criticised these features, and predicted that they would prove very destructive to the track, particularly in their tendency to throw it out of alignment. The wreck at Woodlawn, followed later by another at Greenwich, established the truth of these criticisms, and both locomotives have subsequently been modified, with a view to eliminating as far as possible the defects referred to.

In designing the powerful electric locomotives for the Pennsylvania tunnels, which are illustrated elsewhere in the present issue, the defects of rigid wheel base and low center of gravity were avoided by removing the motor from the axle and placing it above the frames, and by reverting to the wheel plan of the American eight-wheel type, in which there are four coupled drivers and a leading four-wheel truck. It will be seen that if a pair of cylinders were placed above the truck, and the jack-shaft cranks and the coupling rods to the motor were replaced by a crosshead and piston, we would have the familiar steam locomotive arrangement.

It will thus be seen that the locomotives are a compromise between the existing steam and electric locomotives, with the best features of each included. They will combine the even turning effort and absence of unbalanced weights of the electric, with the high center of gravity and flexible wheel base of the steam locomotive. Whether this is destined to be the enduring type, is a matter for the future to determine.

NAVY DEPARTMENT REORGANIZATION.

Since the new plan for the reorganization of the administration of the navy is described by its sponsors as "tentative," they evidently expect that experience will suggest some modifications. This being the case, we have no wish to indulge in what might seem to be captious criticism; for we believe that the Secretary has given his indorsement to the present plan only after a very serious consideration of its utility. Furthermore, we have personal reasons for believing that many of the naval officials who have taken an active part in the recent criticisms and discussions are weary of the protracted controversy, and are anxious to welcome any plan which gives promise of harmonious and economical administration.

Surely, if special boards have done anything to solve the problem we ought by this time to have reached a clear road. The Sperry board, the Leutze board, and lastly the Swift board, were appointed, made their investigations, and duly reported to the Secretary. The present scheme may, therefore, be taken to represent the combined wisdom of the many selected experts who have passed upon the subject.

On one point, however, we do doubt most strongly the wisdom of Secretary Meyer's proposed scheme. We refer to the proposal to take the administration of the navy yards out of the hands of the naval constructors and put the seagoing officers in control. Look at the matter whatever way we will, this move seems about as unreasonable as to take the captains and executive officers of the transatlantic liners from their ships, and place them in full control of the yards in which their ships were built. Our seagoing officers have not the experience or the special technical and mechanical knowledge to qualify them for the position of "works managers." An officer may have a perfect genius for naval strategy and tactics; he may have the most intimate knowledge of seamanship in its broadest sense, of navigation, and, in short, of everything that has to do with the management of a warship when she is in commission, and yet be a very poor mechanic, and have only a very hazy idea of shop and yard management.

If it be necessary—and we believe it is—for the present scheme of reorganization to receive the sanction of Congress, we trust that body will make a very exhaustive investigation of this phase of the question. The Newberry scheme, which has now been for about a year in successful operation, established the naval constructors in practical charge of the administration of the yards, subject to a commandant; it created a single payroll, and placed the care of buildings and grounds, and of all the work coming under the head of civil engineering, under a single manager. The number of separate shops was greatly reduced, and the officers in charge of the various shops were practically inspectors of the work done for their several bureaus. The work of the yards was greatly simplified, expenses were reduced, and there was a greater all-round efficiency. We trust that Congress will modify the proposals of the present scheme as far as they affect the navy yards, and permit them to be run under the present admirable plan. If this modification be made, we believe that Secretary Meyer's reforms will prove to be of lasting benefit to the navy.

THE VALUE OF EXHAUST STEAM.

Apart from its own inherent excellence as a prime mover the steam turbine has been teaching us many valuable lessons about the steam engine; or, to speak more correctly, has been bringing into prominence many facts regarding the steam engine which were known, but whose great importance was being overlooked or neglected. We have all of us known in a general way, for instance, that a high-pressure engine exhausting directly into the atmosphere was extravagant; but it remained for the low-pressure steam turbine to teach us how much power was being lost, and what a large proportion of that power could be recovered by expanding the steam down in a suitable auxiliary chamber. It has already been established that when an exhaust steam turbine is installed as an auxiliary to a non-condensing engine, it can develop from the exhaust steam even more useful work than the engine does from the live steam. Proportionate economies also are realized where an exhaust steam turbine is interposed between the low-pressure cylinder of a compound or triple-expansion engine and the condenser. A notable instance of this is found in the 59th Street power station of the New York Subway, which was originally equipped with the well-known Allis-Chalmers cross-compound engine.

The maximum economical rated power of these engines, as contracted for, was 6,000 kilowatts, with an overload capacity of about 8000 kilowatts. At their normal rating, the engines showed a water rate of about 18 pounds of steam per kilowatt hour, and at maximum overload the consumption ran up to about 22 pounds. By interposing a low-pressure turbine between the low-pressure cylinder and the condenser, it has become possible not only to run the engines with an economical water rate at their full overload, but the total kilowatt output is about doubled, the combined unit developing about 16,000 kilowatts on a water rate of 14 pounds per kilowatt hour. The steam enters the high-pressure cylinders at a gage pressure of from 190 to 195 pounds, the low pressure at from 45 to 48 pounds, the turbine at about one pound, and the condenser is maintained at about 28.8 inches of vacuum. In the expansion from 195 pounds gage to atmospheric pressure 8000 horsepower is developed; and by the interposition of the steam turbine another 8000 horse-power is recovered between the atmospheric pressure and 28.8 inches of vacuum. This is a wonderful advance in steam-engine practice; but that we are still far removed from theoretical perfection is proved by the fact that, even with this successful combination, 60 per cent of the heat units is being carried away by the condenser water into the North River.

A STEAM-TURBINE ELECTRIC LOCOMOTIVE.

Considerable interest has been aroused in British railroad circles by the announcement that the foremost locomotive construction company have perfected a new type of railroad engine, particulars of which were recently given to a Scottish university engineering society by the president of the company in question. It is described as a "steam-turbine electric locomotive;" and as a turbo-electric combination. The first engine of this type, which is approaching completion in the company's shops, possesses many new and ingenious features.

In general design the engine will not differ very materially from the ordinary locomotive now in use. Steam is raised in a boiler of the usual locomotive type, fitted with a superheater, the supplies of water being drawn from tanks disposed on either side of the boiler, and the coal is carried in side bunkers. The steam is led from the boiler to a high-speed impulse turbine running at 3000 revolutions per minute, to which is directly coupled a continuous-current, variable-voltage dynamo. With this generator electrical energy ranging from 200 to 600 volts is supplied to four series-wound traction motors, the armatures of which are built on the four main or driving axles of the locomotive.

The exhaust steam from the turbine is passed into an ejector condenser, and is finally, with the circulating condensing water, discharged into the hot well. Owing to the steam turbine requiring no internal lubrication, the water of condensation is free from oil, and can consequently be discharged from the hot well direct into the boiler by means of a feed pump. In this manner the water can be used over and over again, and the water carried in the supply tanks actually serves as circulating water in the condensing operations. Circulation is effected in a closed cycle by means of small centrifugal pumps, driven by auxiliary steam turbines, placed alongside the main turbine and dynamo. The water thus flows from the tanks through the first pump, by means of which it is forced through the condenser, where it serves to condense the exhaust steam from the turbine, then to the hot well, from which it is pumped to a cooler at the front of the engine, where it comes into contact with a blast of cold air caused by the movement of the locomotive and a fan which serves to cool it, and then it returns to the tank for further use.

In so cooling the water, however, the usual exhaust blast which induces the draft through the furnace and boiler tubes is lost. To remedy this deficiency, a forced draft is supplied by means of a small turbine-driven fan, placed within the radiator or cooler, so that while it serves to cool the circulating water it also induces a blast of hot air to the fire. The cab of the locomotive carries a small switchboard, on which are mounted the controller for grouping the four motors, according to what draw-bar pull is required, in series or parallel, as well as the regulator for controlling the electrical circuit voltage, and consequently the speed of the train.

The whole of this main and auxiliary machinery is mounted upon a strong underframe, carried on two eight-wheeled compound bogies, to facilitate negotiation of curves at high speed. Each bogie carries two of the four driving motors, as already mentioned. It will thus be seen that in reality an articulated system is adopted.

The first engine to be built on these lines is approaching completion, and its performances are awaited with great interest. The experiments which have already been made by the company upon an extensive scale lead them to believe that such a locomotive as this would possess great possibilities and offer a complete solution to the traction question of to-day. In any large well-equipped locomotive establishment an engine can be produced for a low figure in comparison with the electric locomotive, and by the adoption of the new combination they do not anticipate that the prime cost will be very appreciably enhanced.

The Transvaal government have set aside a fairly large sum for the erection of an experimental scrap iron smelting works. Possibly, says Engineering, the movement may eventually extend so that larger works may be built to deal with the native ore. This ore has already been employed with good results in the manufacture of different articles. Speaking of Pretoria ore, the foreman of the railroad workshops says that it is easily fluxed and good iron obtained free of sulphur and phosphorus. A test of local hematite was recently carried out and 633 pounds of iron was obtained from 1,100 pounds of ore used. The Transvaal mines' consumption of iron and steel is estimated at 50,000 tons yearly, valued at £900,000; of this £600,000 consists of rails, sleepers, pipes and pipe fittings, rock drills, and spares. The railroad also purchases about 32,000 tons of rails and sleepers annually. There is therefore scope for the opening of works, but the government mining engineer considers that the provision of blast furnaces must be a matter for private enterprise. Perhaps some day South Africa may take its place among the great manufacturing countries of the world, but that state of affairs is a long way off at present, and for many years that country will have to depend on its gold and diamonds, and in a lesser degree on its agricultural productions.

ENGINEERING.

It is said that Russia will give a contract to an American syndicate to develop the Transsiberian Railway and double-track the line throughout.

The third Pennsylvania tube under the East River to Sunnyside yard, Long Island City, has been practically completed.

Five miles of the Panama Canal have been opened to navigation. This includes the channel from the point in the Bay of Panama, where the water is forty-five feet deep at mean tide, to the wharves at Balboa. Steamships are using this part of the canal daily.

The number of railway accidents during the year ending June 30th, 1909, was 66,711, or 2,791 killed, and 63,920 injured. This is a decrease in the total number of 6,042, or 973 killed and 5,069 injured, as compared with the number reported in the previous year. Even the reduced figures do not speak very well for the safety on our railroads.

The great railway bridge across the Sioule gorge in France was opened a short time ago. The height of the bridge is 450 feet above the ground. The bridge consists of a continuous girder 40 feet deep, divided into three spans by two intermediate masonry piers 370 feet high. The main span is 470 feet long, and each of the outer spans has a length of 380 feet.

The Public Service Commission has just issued a synopsis of the report of the Interborough Rapid Transit Company, including both the Subway and Elevated divisions, for the year ended June 30th, 1909. The subway carried 237,451,171 passengers at a total expense of $4,547,620—something less than two cents a passenger. The elevated division carried 275,737,974 passengers. The operating expenses on the subway were $4,457,620, and on the elevated $6,199,823.

Arrangements are being made to consider proposals for a fast passenger and mail steamship and train service from London to Australia and New Zealand by way of Canada, and an 18-knot service on the Pacific. The subsidy aid which would have to be given by British colonial governments would be very heavy. The Australian government demurred at first, but has finally agreed to share in the cost, and a conference will meet in London early in the spring to consider the details and apportion the cost.

A new steamship service will shortly be established between New York and Washington, and freight steamships will be in operation by the first of next year. It is estimated that the journey from New York to Washington will take from thirty-six to thirty-eight hours, including stops. A daily service of passenger steamers is in contemplation. The Potomac River serves an immense territory on either side, which is now largely without modern facilities for traveling or sending goods to market. Wharves are being built, and small steamboats will pick up the freight and carry it to the landings of the large steamships. The country on each side of the Potomac is very fertile; the eastern shore of Maryland produced 4,000,000 barrels of potatoes last year. The great difficulty has been to get the produce to market.

The following notes concerning the storage of California or crude oil in concrete reservoirs were recently given in Concrete. A 1,000,000-barrel reservoir, lined with concrete, has recently been completed at Port Richmond, Cal., and one of 800,000-barrel capacity is under construction near Bakersfield. The practice is to excavate the earth, which in most fields is a sandy loam, porous and very dry, to about one-third the depth of the proposed reservoir. With the material removed, a levee is built round the excavation, having side slopes of 1 : 1½ on both faces. The bottom and sides are then covered with about 3-inch concrete, often reinforced with expanded metal or some equivalent. Small cracks that occur at the junction of the sides and bottom and along the line between the cut and the embankment soon become filled with sediment and are believed to permit the leakage of very little oil. A number of such structures in southern California have recently been examined, and no signs of depreciation in the quality of the concrete were found.

The recent deplorable mine accident at Cherry, Ill., in which there were hundreds of deaths, brings up the question of expert direction in such disasters. Untrained volunteers are entirely useless, as was demonstrated in France a couple of years ago, when about twenty rescuers went down in a mine to their death. The expert life-savers from the Westphalia mines, who were sent by the Kaiser, with their tested ropes and other tackle, came too late, but their work demonstrated that if they had been called in earlier, they might have saved a large number. The cost of expert direction in accidents would not be very great, and it seems as though if we protect our coasts by guards, we might also do something to protect our miners. A few men who are especially fitted could be organized and drilled in each district, and the mine owners themselves might be made to furnish the necessary equipment, which would not be a very great tax on any operators.

SCIENCE.

Dr. Percival Lowell is installing a 12-inch telescope on San Francisco Peak at an altitude of 13,000 feet. Prof. V. M. Slipher will have charge of the task of erecting the big telescope.

The discovery of a new Alhambra at Ronda, south Spain, by Lawrence Perin of Baltimore is reported. Mr. Perin recently purchased the well-known Casa del Rey Moro, and proceeded to make excavations. He found large numbers of Roman and Arabian gold coins and revealed vast galleries.

The Italian Parliament will soon be called upon to provide for a special department to unroll and decipher papyri discovered at Herculaneum. It is trusted that this action may be taken immediately. Some previous documents have been damaged irrevocably because of legislative delay and neglect.

The American Museum of Natural History is to use designs of the famous Mitla ruins of Mexico for the new restaurant which is now being planned. The Mitla ruins were built of adobe and stone ornamented with mural painting and mosaic work produced by stones set in cement. The restaurant will therefore serve the purpose of an exhibition hall.

Some time ago it was ascertained that radium emanations were absorbed by the surface of lungs and intestines, but not by the skin, at least under ordinary conditions. The greater part of the absorbed emanation is quickly eliminated by the lungs; a small part passes away with fecal matter; and finally some has been found in the liver and the bile, but none is ejected with the urine or perspiration.

An international conference is proposed for the preservation of the fur seal and all marine mammals, including whales, walruses, sea lions, and sea elephants. Some of these animals are now all but extinct, and the government considers it time to formulate an international law for their preservation. The Japanese seem to be the chief offenders, for they have even ventured within the three-mile limit to carry on their work of destruction.

In a new process of keeping eggs in cold storage, 500 eggs are packed in a tin box, and a little calcium chloride is added, to insure dryness. A lid, having a hole 1/5-inch diameter, is then soldered on and the box, with a number of others, is placed in a large iron cylinder, from which the air is then exhausted. By this operation the air and carbon dioxide dissolved in the albumen are removed, as well as the air which surrounds the eggs and fills their voids. The cylinder is next filled with pure carbon dioxide, and a pressure slightly above that of the atmosphere is maintained until the constancy of the manometer indicates that the eggs are saturated with the gas. But as eggs do not keep well in pure carbon dioxide, a certain quantity of this gas is next withdrawn from the cylinder and replaced by nitrogen, obtained either from the cylinders in which it is sold in a compressed state or by passing air over red-hot copper. When the eggs have become saturated with the mixture of gases, the boxes are removed from the cylinder, sealed, and placed in rooms where the temperature is kept between 32 and 36 deg. F. By this process the eggs are kept in an atmosphere which contains no free oxygen, and in which the proportions of carbon dioxide and nitrogen are the same as exist in the albumen of fresh-laid eggs.

Whether or not there is a planet beyond Neptune is a problem which has long concerned mathematical astronomers. Among those who have taken the trouble mathematically to settle the problem of such a planet's existence is Prof. W. H. Pickering, who used the method of Leverrier, the discoverer of Uranus. Prof. Pickering believes in the existence of at least one such planet, which he has designated by the letter *O*. A search for this planet was recently undertaken by the Rev. J. H. Metcalf with his 12-inch doublet, but without success. The reasons adduced in Science by Prof. Pickering for this failure are the following: (*a*) The planet may be unexpectedly faint, or reddish in color. Its computed magnitude is 13.5. (*b*) The orbit may be highly eccentric, the computation being based on an approximately circular orbit. (*c*) The orbit may be highly inclined to the ecliptic, and the planet at present situated far from its node. For various reasons the first two causes are not thought sufficiently effective to interfere with the discovery of the planet. We might, by analogy, compare planet *O*, on account of its relative size and position with regard to the other planets, to the sixth or seventh satellite of Jupiter. The inclinations of the orbits of these two bodies are 28 deg. and 26 deg., respectively. The region already covered in the photographic search extends along the ecliptic for 25 deg., and reaches to a maximum distance of 10 deg. to the north and south of it. It is expected therefore to make an examination of the higher latitudes next year. The number of stars already examined in the search is estimated at about 300,000.

AERONAUTICS.

Recognizing that all the leading European nations are rapidly developing aerial fleets of both lighter-than-air and heavier-than-air machines, Gen. James Allen, the chief signal officer of our army, made an especial plea in his annual report to the Secretary of War last week for a definite plan of aeronautical development in the army. It is to be hoped this will be given the attention it deserves. Our War Department was the first to order an aeroplane, and it should not fall behind now in aviation or aerostatics.

The second week in December is noteworthy from the fact that Maurice Farman, a brother of Henry Farman, started to make the first cross-country tour ever attempted by aeroplane. Leaving Buc, near Versailles (France), at 2:52 P. M. December 9th, he arrived at Chatres (42 miles distant) in 53 minutes, flying over Trappes and Rambouillet *en route*. His biplane, which resembles that of his brother, averaged 47 miles an hour in making this flight. The weather was fine, there being scarcely any wind. The flight formed the first stage of a trip to Bourdeaux, which M. Farman hoped to complete in four or five additional flights.

The Wright Company has recently been incorporated in New York for the manufacture of the Wright aeroplane in the United States. The company is capitalized at $1,000,000, Wilbur Wright being president and Orville Wright vice-president. Among the directors are such men as Cornelius Vanderbilt, Howard Gould, and August Belmont. The company will erect a factory at Dayton, Ohio—the home of the Wright brothers—and will also have an aviation field where purchasers can be taught the operation of the machines. It is expected that many American sportsmen will soon become interested in aviation and own aeroplanes.

On the 8th instant Earl Gray, Governor General of Canada, Lord Lacelle, and several other prominent Canadians visited Dr. A. G. Bell's laboratory at Beinn Behreagh, near Baddeck, N. S., and, in the absence of Dr. Bell, were shown about by Messrs. Baldwin and McCurdy, who are still associated with him in his experimental work. A demonstration was given of a new hydroplane boat, which rose completely out of the water in a short run of a few hundred feet. It is expected to use this boat beneath an aeroplane, so as to make possible the ascent from water. Despite a hail storm and a soggy field, Mr. McCurdy treated the visitors to a flight of a mile in the "Baddeck No. 2," the second biplane that he and Mr. F. W. Baldwin have constructed this year, and the one with which a considerable number of successful flights have been accomplished. Altogether, there are a half dozen different heavier-than-air machines ready to be tried out on the ice of the Bras d'Or lakes at Baddeck this winter.

The first tests in the United States of firing at balloons were carried out at the Sandy Hook proving grounds on November 27th, when a small 3-man captive balloon was anchored at a height of 300 feet and fired at from a distance of 2,000 yards. Fifteen shots were fired from a special 1-pounder having a range of movement from horizontal to vertical, without hitting the balloon. A larger field gun that could be elevated to about 40 degrees was also tried with smoke-producing shells, several of which passed over and several below the balloon. A third kind of shot was a shrapnel which exploded at a certain set distance, and discharged backward a score or more of balls in a widely expanding cone. The balloon was brought to earth by one of these shot. Before the completion of the tests, which lasted several days, 90 shots were fired with but 3 hits. Two of these were without effect. As a result of the tests, army officers believe it will be almost as difficult to hit and destroy a dirigible balloon as an aeroplane.

At the meeting of the Aeronautic Society on December 2nd, Dr. Spratt of Coatesville, Pa., an intimate friend of Mr. Octave Chanute and an aeronautic experimenter of many years' standing, gave a brief talk upon his work in connection with the aeroplane. After calling attention to the fact that all animals walk or move over the ground irrespective of the number or length of their legs, just the same as all flying creatures navigate the air no matter what the size or shape of their wings, Dr. Spratt said he believed flight depended upon a general principle as simple as that of the lever, which governs walking, but that man had difficulty in discovering this principle since he was not making use of it universally, as in the latter case. Of late years he has devoted himself to finding this principle, in which quest he believes he has met with success. As a result, he has lately applied for a patent upon an aeroplane in which it is embodied. He spoke of having discovered in his early experiments the curve now used on the Wright biplane surfaces. At the suggestion of Mr. Chanute the Wrights made quantitative tests of surfaces having this curve and, finding it satisfactory, adopted it. Dr. Spratt was with the two brothers three seasons at Kitty Hawk, and was an interested witness of their first flights with a motor.

THE NEW PENNSYLVANIA RAILROAD ELECTRIC LOCOMOTIVES.

It is a curious instance of what might be called the vagaries of mechanical evolution that the latest and most powerful electric locomotives, of which we present illustrations, should be furnished with those side rods and connecting rods, the abolition of which from the electric locomotive was considered to be one of its principal points of improvement.

Theoretically, to get rid of the reciprocating movements and unbalanced rotating weights of the steam locomotive was eminently desirable, for these unbalanced weights were the cause of much destructive wear upon the track and roadbed. Furthermore, the substitution of the compact electric motor, encircling the driving axle, was considered to be an ideal arrangement of compactness and efficiency.

When the electric drive came to be applied to steam railroads, as in the case of the electrification of the New York Central and the New Haven roads, it was found that the above mentioned advantages were obtained at the expense of collateral disadvantages of a very serious character, for the low center of gravity, the rigid wheel base, and the large amount of non-spring-supported weight combined to make the locomotives very destructive of the track. Both locomotives met with serious accidents, the former bursting open the track on a curve near Woodlawn, and the latter doing the same thing when hauling the White Mountain express at high speed through Greenwich, Connecticut. The running of both types of locomotive has since been greatly improved by the substitution of four-wheeled leading trucks on the New York Central locomotive, and the introduction of pony trucks on the locomotives of the New Haven road.

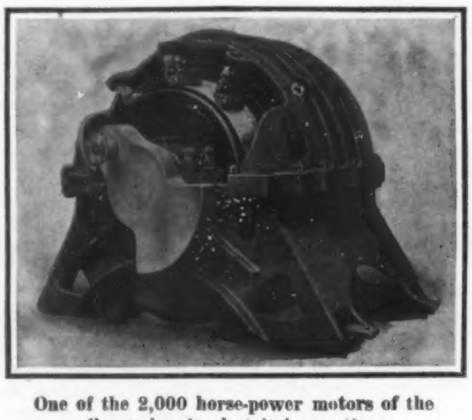
In designing the locomotives to be used in the New York tunnel extension of the Pennsylvania Railroad, the engineers of the railroad company and of the Westinghouse Electrical Manufacturing Company have profited by the valuable experience of the past few years, and have designed an engine which will have the high center of gravity and flexibility of wheel base which characterize the steam locomotive. It consists of two duplicate sections. The wheel plan of each section is the same as that of the old eight-wheel American steam locomotive, and consists of four coupled drivers and a four-wheeled truck.

The sections are permanently coupled back to back by a special arrangement of Westinghouse friction draft gear and levers, so that the leading section effectually pilots the rear one. This obviates all necessity of turning the engine, which runs equally well in either direction. All manipulating levers are duplicated in each section, so the operator simply changes ends.

The most original feature of this engine, at least in American practice, is the removal of the motors from the wheel axles and the substitution of a single motor which is placed above the frames and within the cab. This motor weighs, without gear, 45,000 pounds, and in weight and power it is the largest railway motor ever constructed. At each end of the rotor shaft is a crank, the two being set, as in steam locomotive practice, at ninety degrees. From these cranks a pair of coupling rods lead down to a crank-shaft (known as a jack shaft) which is carried in the frame in a horizontal line with the axles of the driving wheels. The jack shaft cranks are coupled to the drivers.

Now it will readily be seen that this arrangement avoids all the difficulties of counter-balancing which have been such a nightmare to the steam locomotive designer and to the track superintendent, for, since the motor crank revolves uniformly and at constant effort, differing therein from steam practice, the turning effort of the drive wheels is the same as for the motor, and is constant throughout each revolution. Moreover, it will be seen that since the movements of all rods and moving parts are those of pure rotation only, it is possible to secure perfect counterbalance, and the engine delivers no more shock to the track and roadbed than a passenger car of equal weight.

The motor and massive side frame, the jack shaft, and all other gear, are spring supported from the driver and truck wheels, so that there is no track stress other than that local to a single pair of wheels. In this arrangement of motor support and connection,



One of the 2,000 horse-power motors of the Pennsylvania electric locomotives.

the center of gravity height closely approximates that in the best high-speed locomotives.

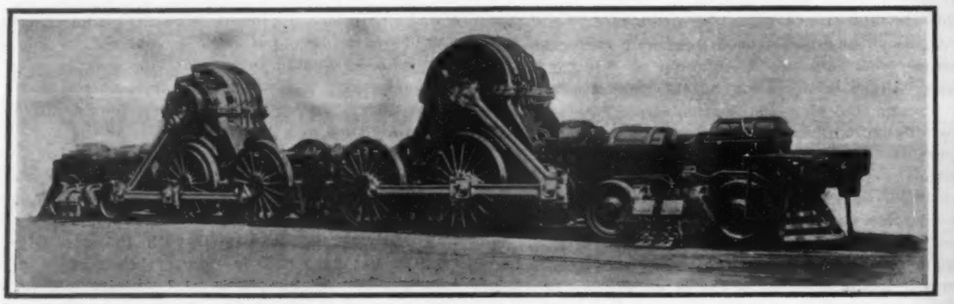
A decided improvement in the "Pennsylvania" type is the use of a single motor for two pairs of drivers, and the benefits secured by its position. The motor is located high up from the roadbed, secure from snow, dirt and water, and its design embodies electrical features never before secured on an electric locomotive.

The first twenty-four locomotives to be built will have the following dimensions:

Total weight, 166 tons; total horse-power, 4,000; maximum draw bar pull, 60,000 pounds; maximum speed, 60 to 70 miles per hour under load; diameter of drive wheels, 68 inches; diameter of truck wheels, 36 inches; weight on drivers, 104 tons; length over all, 65 feet; total wheel base, 56 feet.

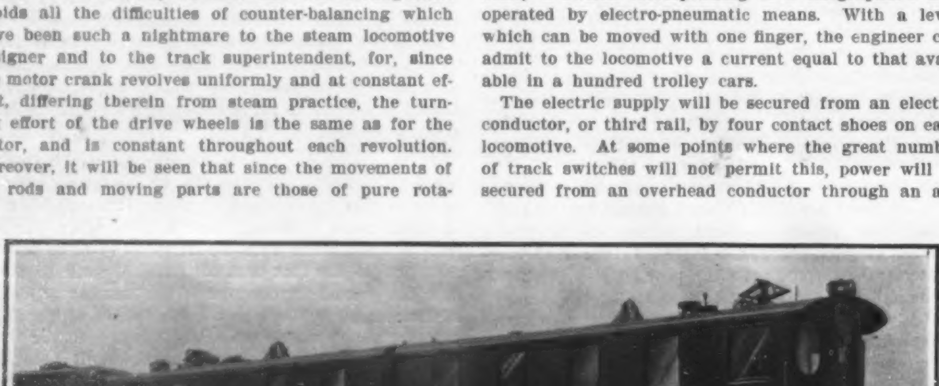
The controller on the "Pennsylvania" type is scarcely as large as that on a Hoe printing press. None of the main power passes through it, as it is really a switch corresponding to a telegrapher's key, operated by electro-pneumatic means. With a lever which can be moved with one finger, the engineer can admit to the locomotive a current equal to that available in a hundred trolley cars.

The electric supply will be secured from an electric conductor, or third rail, by four contact shoes on each locomotive. At some points where the great number of track switches will not permit this, power will be secured from an overhead conductor through an air-operated overhead contact shoe, of which there are two on each locomotive. The first locomotive, which is now being tested both as to speed and hauling power on the Long Island Railroad, is giving satisfactory results.



Drive wheels, 68 inches diameter. Truck wheels, 36 inches. Length over all, 65 feet.

Chassis of the new electric locomotive.



Weight, 166 tons. Horse-power, 4000. Drawbar pull, 60,000 pounds.

THE NEW PENNSYLVANIA RAILROAD ELECTRIC LOCOMOTIVE

Electric Traction in Tunis.

In the region of Tunis there has been installed an extensive system of electric traction lines. The new electric sections, which are now in regular running, are designed to replace the former steam railroad. This latter comprised three lines, one of these running from Tunis to La Goulette, about 10 miles distance, the second from the city to Marsa, 11 miles, and the third from La Goulette to Marsa, about 5 miles. The region covered by the lines is of interest as being the site of ancient Carthage and its extensive suburbs. The first two sections had a common portion of about 6 miles between Tunis and Aouina. The steam lines had been conceded in 1871 to an English company which turned them over to the Florio Rubattino company ten years later, and they afterward passed into the hands of the Bone-Guilma railroad company. The government made an arrangement in 1905 with the Tunis traction company to have the lines changed to the electric system. This was carried out by the Paris Thomson-Houston firm, and the government wished to profit by the jetty which had been laid across the Tunis Lake so as to use it for the line as far as La Goulette and thus run in a straight path. The old traject is kept between La Goulette and Marsa, but there is also a second branch which runs nearer the sea coast, traversing the site of Carthage and reaching the elevated locality of Sidi-bou-Saïd, then descending to the terminus at Marsa.

The object of the new line is to enable the population of Tunis to reach the seashore easily and rapidly, and the new shore branch could not be realized by the steam road on account of the irregular ground covered here. It is expected that the suburban region will be much more developed by the use of the electric line. At present the trains are made up on the multiple-unit system of two motor cars and from one to three trailers. The motor cars are fitted with two motors of the G E-66 type which run on 600 volts on the overhead wire or third rail, and give 125 horse-power, using two series-parallel controllers. With front and rear motorman's cabins, the cars have first and second-class compartments and also a baggage or light freight compartment. The chassis has two bogies, one of which carries the motors. Current is taken by third rail for the suburban part of the line, and it is only within the city that the trolley is used. The motor cars weigh 28 tons and contain 100 places, while the trailers, of an equal capacity, weigh 22 tons.

The Great St. Petersburg Ozone Plant.

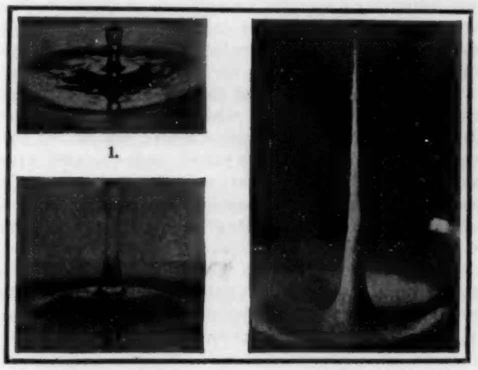
In view of the very satisfactory results obtained by the purification of the water of the Neva in ordinary sand filters, when the epidemic of cholera was prevalent in St. Petersburg about a year ago, the municipal douma and the authorities of the city have decided to erect a large plant for ozonizing water. It is only just to say that the cholera infection is to be attributed in this recent outbreak to the defective nature of the actual system of distribution, which is incapable of retaining the bacteria. On the other hand, the sanitary authorities of the government, as well as those of the city of St. Petersburg, are of the opinion that sterilization by ozone is the only method which is able to assure a radical purification of the drinking water of the city, their investigations, as well as those of the Instituts Pasteur and Koch, having demonstrated the perfect bactericidal quality of ozone as the best means for completely destroying the microbes contained in water. This large ozone plant, combined with an installation of rapid filtration (Howatson system) will be laid out according to the combined systems Siemens-de-Frise-Otto. The electrical portions of the ozone apparatus will be constructed by the Siemens & Halske Company and the plant of Felten Guilleaume-Lahmeyer.—La Nature.

THE LIFE OF A SPLASH.

BY PERCY COLLINS.

Probably many people have at times watched the splashes caused by rain drops falling upon the smooth surface of a pool or river. Some, too, may have gone so far as to differentiate between the splashes formed by the big drops of a thunder shower and those produced by the smaller drops of a gentle rain. In the former case a conspicuous bubble floats for a moment, and then vanishes; in the latter a crystalline fountain seems to start from a surrounding coronet of lesser jets—though this is in part an illusion, for it is known that in reality the coronet has vanished before the jet appears. The image of the coronet has not had time to fade from the eye ere that of the jet is superposed upon it. Moreover, it may have chanced to the reader to note the different effects, both of sound and of splash, produced by a stone dropped into the water—these differences apparently depending upon the height from which the stone descends, and upon the condition of its surface; i. e., whether it is smooth or rough, wet or dry. But if the reader has at one time or another made such naked-eye observations of splashes, it must be clear to him that while he has seen something, he must also have missed seeing very much more. For a splash, no matter in what way it may be produced, consists in the progress of a multitude of events, compressed within the limits of a few hundredths of a second, but none the less orderly and inevitable, and of which the sequence is in part easy to anticipate and understand, while in part it taxes the highest mathematical powers to elucidate.

Some fifteen years ago, Prof. A. M. Worthington, C.B., F.R.S. (Head Master of the Royal Naval Engineering College, Devonport, England), commenced a systematic study of splashes, and in order fully to appreciate the disturbance of the liquids with which he experimented, and their relations, he invoked the aid of photography. In these days of kinematographs and rapid snap-shot cameras, it might seem an easy matter to follow, by means of photography, even a splashing drop. But if the reader harbors this thought, he has failed to grasp the extraordinary rapidity of the movements which take place. As Prof. Worthington reminds us, the problem of how to photograph a splash is by no means a simple one, for the changes of form that take place are far too rapid to come within reach of any ordinary kinematograph, while the quickest photographic shutter is also much too slow. Thus, it became necessary to have recourse to the far shorter exposure of an electric spark. It was found that the bright spark given by breaking the primary circuit of an induction coil at the surface of mercury was of much too long duration to be useful for the purpose of flash photography; so that the originals of the photographs reproduced on this page (for which we are indebted to the courtesy of Prof. Worthington) were taken by means of a spark the duration



1. 2. 3.

1. Primary column succeeding a drop into running water. 2. Column succeeding a drop into still water. Time, 0.139 second each case. 3. Primary column caused by a rough sphere falling into liquid.

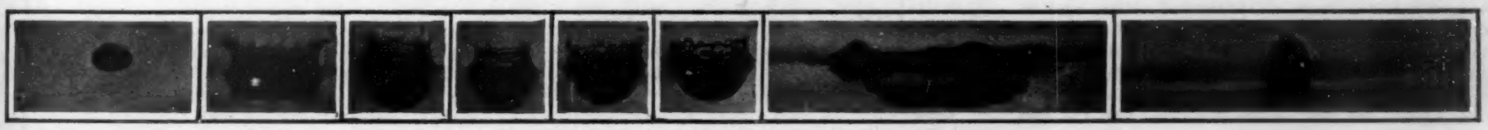
of which was certainly less than three-millionths of a second—a period of time which bears to the whole second about the same proportion as a day to a thousand years.

This flash is obtained by charging two Leyden jars by an electrical machine on their inner coats, one positively and one negatively. Stout wires lead from the outer coats to the dark room (where the splash is to be photographed) and terminate in a spark-gap between magnesium terminals and close over the surface of water contained in a bowl. The inner coats of the Leyden jars being now connected together, the positive and negative charges unite in a dazzling flash, and a simultaneous discharge and flash take place between the two outer coats across the spark-gap in the dark room. This latter is the illuminating spark, by means of which the photographic exposure is to be made. The exact timing of this spark is obviously of the greatest importance. This is effected by means of a falling metal sphere which passes (outside the dark room, of course) between two terminals connected one with the inside of one Leyden jar and one with the inside of the other. These terminals are just too far apart for a spark to jump across till the timing sphere passes between them. But when this occurs the discharge takes place, with the accompanying flash in the dark room. By means of an ingenious arrangement of magnets and springs, for full details of which the reader is referred to Prof. Worthington's work ("A Study of Splashes"), the timing sphere can be made to fall either simultaneously with the drop or sphere destined to cause the splash to be photographed, or slightly earlier or later. In this way it is possible brilliantly to illuminate the splash for one three-millionth part of a second at any desired period of its progress. For example, if a particular stage of the splash is photographed when the timing sphere falls just four feet to the gap between the terminals, then by raising its releasing-lever about two-fifths of an inch, the law of falling bodies insures that the flash will be postponed by just one-thousandth of a second, and the next photograph accordingly reveals a stage just so much later.

From these brief particulars the reader will be able to form an idea of the way in which Prof. Worthington's photographic studies of splashes are obtained. The camera being previously focused and arranged in the dark room, the timing sphere is minutely adjusted and released, and a record of any desired period of the splash is obtained upon the sensitized plate. Yet despite the rapidity of the plates employed, and the brilliancy of the flash, the duration of the illumination is so short that the negatives are always "under-exposed." Hence tedious precautions have to be taken in their development.

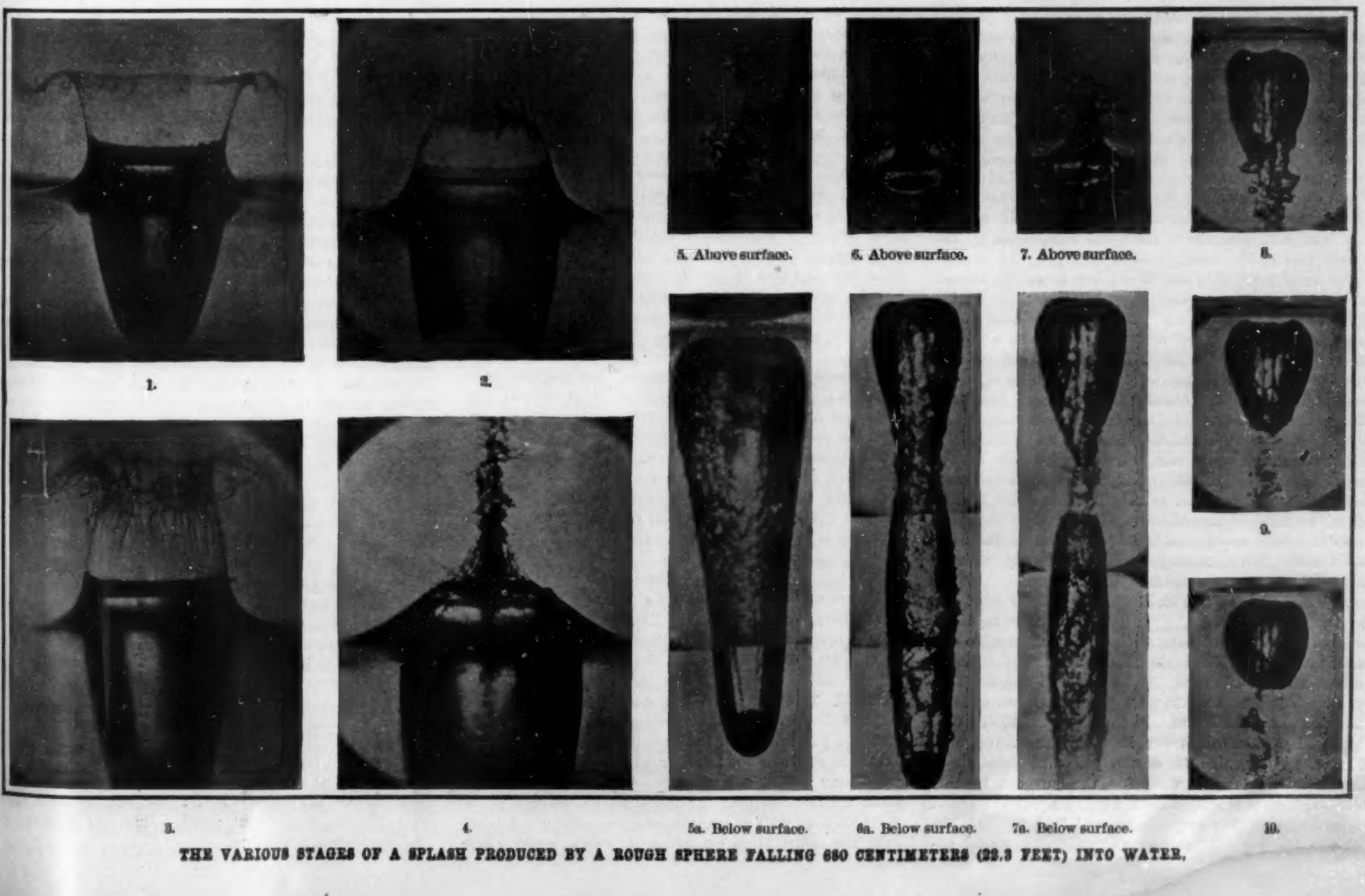
We may now glance rapidly at a few of the many interesting facts which have been established by Prof. Worthington's study of splashes. It will probably surprise the reader to learn what a lengthy series of events follows the contact of a small drop of water, falling from a height of about 16 inches, into a mixture of milk and water—the milk being added to render the photographs more intelligible. First, as the drops strikes and penetrates the surface, there arises a crater, which rapidly increases in size until, upon

(*Continued on page 474.*)



The falling drop. T=0. T=0.012. T=0.016. T=0.023. T=0.039. T=0.055. T=0.070.

The phenomena of a drop of water falling 40 centimeters into water.



1. 2. 5. Above surface. 6. Above surface. 7. Above surface. 8. 9. 3. 4. 5a. Below surface. 6a. Below surface. 7a. Below surface. 10.

THE VARIOUS STAGES OF A SPLASH PRODUCED BY A ROUGH SPHERE FALLING 680 CENTIMETERS (22.3 FEET) INTO WATER.

Prof. Jonnesco and Spinal Anæsthesia.

The visit of Prof. Thomas Jonnesco to New York has brought prominently before the public the method of producing local anæsthesia by the injection of anæsthetic solutions into the spinal canal.

Cocaine was introduced years ago as an anæsthetic for local application; it was welcomed by the medical profession, and equally by patients, on account of its invaluable services in operative procedures upon the eye, the nose, and the throat. By merely placing a drop or two of a solution of cocaine (or one of its salts) into the eye, or by painting a similar solution upon the mucous membrane of the nose or throat, it is possible to produce anæsthesia so complete as to enable surgical operations to be performed upon these parts without inflicting the least pain or discomfort upon the patients. Certain objections to the use of cocaine were not long, however, in showing themselves. Cocaine is a powerful alkaloid; and if the usual dose be exceeded, very grave results follow, a number of patients having actually died as the result of cocaine poisoning. Investigators were therefore led to search for other substances, either like cocaine occurring naturally, or prepared synthetically, which would possess the properties of cocaine while being less poisonous.

In this way, states Nature, a number of anæsthetic drugs have been introduced, including alypin, holocaine, eucaine (alpha and beta), scopolamine, novocaine, stovaine and tropacocaine. Of these the three latter have been chiefly employed in producing spinal anæsthesia. The method consists in injecting, by means of a syringe and needle, a quantity (usually about one cubic centimeter) of a solution of one of these substances into the spinal canal. The injection is made in the back, close to the middle line, the needle being inserted between two of the vertebræ. With regard to the details of the method, various procedures have been described, and no agreement has yet been reached as to which of these is to be considered the best. There is no doubt that modifications are desirable to suit particular requirements. Thus, many operators direct that the drug be dissolved in cerebro-spinal fluid or else in a saline solution having the same specific gravity and the same osmotic tension as the blood-serum. Others consider that the anæsthetic solution should be considerably denser or more viscous than the cerebro-spinal fluid, and for this purpose recommend the addition of glucose or of gum-acacia to the solution. These thicker solutions tend to remain at the spot at which they are injected, while solutions in cerebro-spinal fluid or in normal saline tend to spread up and down the spinal canal, and thus have a more widespread anæsthetic effect. It is usual to withdraw a few cubic centimeters of cerebro-spinal fluid from the spinal canal before injecting the anæsthetic fluid. There are two reasons for this—first, the surgeon is assured that he has actually introduced his needle into the spinal canal, and secondly he is certain to avoid increasing unduly the cerebro-spinal pressure when he introduces the anæsthetizing fluid.

On introducing the fluid into a particular part of the spinal column, anæsthesia is produced of all parts of the body deriving their nerve supply from this part of the spinal cord, and all parts below. If the fluid be allowed to ascend the spinal canal (e. g., by raising the hips) the anæsthesia rises higher and higher as the anæsthetic fluid reaches the trunks of the nerves arising from the higher parts of the spinal cord. If the patient be placed on one side while the injection is being performed, the anæsthetic fluid can be made to enter one lateral half of the spinal canal, and in this way it is possible to limit the anæsthesia to one lateral half of the body.

The anæsthetic fluid can be allowed to ascend almost to the top of the thoracic spine without fear of untoward consequences. When it reaches the base of the neck, however, the phrenic nerve, concerned with the movements of respiration, becomes involved, and it was deemed impracticable to produce anæsthesia of the head and neck by the spinal method. Prof. Jonnesco, however, has shown that the addition of strychnine to the anæsthetic solution produces so powerful a stimulant effect upon the respiratory center in the brain that it is possible to introduce an anæsthetic fluid into the upper part of the thoracic spine, and to allow the fluid to ascend the spinal canal in the neck so as to enable operations to be performed on the neck and throat. But it is as yet too early to say whether this method may be considered a safe one.

Of the three drugs which are now chiefly used for the production of spinal anæsthesia, stovaine is found to produce the most deleterious effect upon the kidneys, acute nephritis having followed its injection in quite a number of cases. Novocaine and tropacocaine are less injurious in this way, while they are equally efficacious as anæsthetics. It thus appears likely that they will supplant stovaine in the near future, and, in fact, tropacocaine in a one per cent solution is already being largely used for the purpose in this country, the usual dose injected being about 1¼ grain.

No doubt further experience will lead to modifications in the present method of performing spinal anæsthesia which will result in its widespread use, as there are a great many cases in which a local anæsthetic is far more advantageous to both patient and surgeon than a general anæsthetic.

A SIMPLE AND RAPID METHOD OF MEASURING THE HEIGHT OF AN AEROPLANE ABOVE THE GROUND.

The vertical plane in which the height of an aeroplane above the ground is to be taken, is determined beforehand and marked on the ground by two stakes sufficiently far apart and long enough to allow the two observers commissioned to take the measurement to note the precise moment when the aeroplane comes into the plane determined by the two stakes.

The base $O_1 O_2$, or line of this plane on the ground, is carefully measured and with as much precision as desired. This can be any desired length, say 500 feet. At O_1 and O_2 two observers are placed, each provided with a theodolite-like instrument, or any other apparatus used in artillery for measuring the angles α and β made by the straight lines $O_1 M$ and $O_2 M$ with the base $O_1 O_2$. This measurement must be taken simultaneously by the two operators at the precise moment the aeroplane crosses the vertical plane $O_1 A B O_2$. This much given, we purpose determining the height $m M$ or h: a simple examination of the diagram shows that we can write:

$$O_1 m = h \cot \alpha$$
$$O_2 m = h \cot \beta$$

Adding these two equations, member to member, we have:

$$h \; (\cot \alpha + \cot \beta) = O_1 m + O_2 m = O_1 O_2$$

Whence

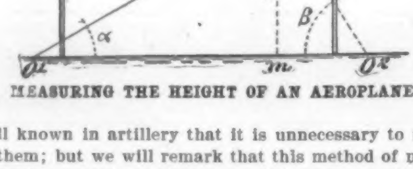
$$h = \frac{O_1 O_2}{\cot \alpha + \cot \beta}$$

If the angle measuring apparatus is graduated and gives directly the lengths of the cotangents, we shall have, supposing $\cot \alpha = a$ and $\cot \beta = b$:

$$h = \frac{500}{a + b}$$

It is easy to see that with a slide rule a simple reading will immediately give the value of h.

Instruments for measuring angles α and β are so



MEASURING THE HEIGHT OF AN AEROPLANE

well known in artillery that it is unnecessary to refer to them; but we will remark that this method of measuring is susceptible of great precision and should give satisfaction not only to the aviators themselves but also to the official observers.

Although altitude trials are not made often, the writer hopes, in the near future, to make some height measurements by this method, with the help of a very ingenious apparatus that measures the angle and at the same time determines the plane.—A. Boyer-Guillon, C.E., in L'Aerophile.

A Novel Science Entertainment.

Mr. H. Snowden Ward of Hadlow-Kent, England, is giving a new science entertainment on the plan of Prof. Pepper's and others entitled "The Marvels of Photography." After a brief explanation accompanied by a few pictures of the developing tanks, by means of one brilliant light the audience is photographed simultaneously with several cameras directed to various parts of the hall. Two very large prints are made on developing-out paper in full view of the audience.

An assistant at the same time makes natural color exposures with autochrome plates on a special subject, and also transparencies from the regular negatives of the audience. The immense paper prints of the audience are then displayed, and later the transparencies and color pictures are projected by a lantern upon a large screen. Under the auspices of the Camera Club of New York, this entertainment is to be given in this city during the winter by Mr. Ward.

To Our Subscribers.

We are at the close of another year—the sixty-fourth of the Scientific American's life. Since the subscription of many a subscriber expires, it will not be amiss to call attention to the fact that the sending of the paper will be discontinued if the subscription be not renewed. In order to avoid any interruption in the receipt of the paper, subscriptions should be renewed before the publication of the first issue of the new year. To those who are not familiar with the Supplement, a word may not be out of place. The Supplement contains articles too long for insertion in the Scientific American, as well as translations from foreign periodicals, the information contained in which would otherwise be inaccessible. By taking the Scientific American and Supplement the subscriber receives the benefit of a reduction in the subscription price.

THE ENORMOUS CROPS OF 1909.

About a month ago, the preliminary estimates of this year's crops were published by the Bureau of Statistics. While not establishing a record, the figures were considerably in excess of those of last year, and were not far from the record established in 1906. However, figures above a thousand mean nothing to the average man, and no conception of this enormous production can be obtained unless he actually sees the entire crop. We have estimated the size of these crops, and our front-page illustration this week shows what a stupendous heap they would make if the more important crops were piled up in Madison Square alongside the Metropolitan Tower. To be sure, Madison Square and many blocks surrounding it would be completely lost under the mass of cereals and potatoes.

The corn, which is the bulkiest of the products shown, is represented as contained in huge bags piled up in pillars so as to represent mammoth corncobs, and though the piles reach up to a height of 1,780 feet, this year's production of corn would make twelve of these pillars. Next to the corn we have the production of oats, amounting to a huge total of close to a billion bushels. The huge bag containing this quantity of oats would reach up to more than double the height of the Metropolitan Tower. The wheat, which comes next in order, would require a bag almost as large which, even when laid on its side, would overtop the tallest structures in New York. If this wheat was distributed among the inhabitants of this country, every one, man, woman, and child, would receive over eight bushels for his share of the crop. If this quantity were taken to a flour mill, it would be converted into one and two-thirds barrels of flour, and out of this quantity of flour a baker could make nearly five hundred loaves of standard five-cent size. In other words, we grow enough wheat in this country to supply every individual with a loaf and a half of bread per day. This is slightly more than the average supply per capita for the last forty years.

Comparing our crops with other countries, we find that the United States leads the world in the production of corn, oats, and wheat. Last year we did not equal European Russia's oats production, but this year's estimate is 176,000,000 bushels more than that of last year; and while the figures for the 1909 crop in Russia are not as yet available, it seems improbable that they will equal our own figures for this year. When it comes to barley, we must take second place, acceding first place to Russia. Russia also leads the world in the production of rye. We stand fourth in the production of potatoes, with Germany, Russia, and Austria ahead of us.

While we may flatter ourselves on our production of corn, oats, and wheat, the figures show that we do not make the best use of our acreage. The United Kingdom seems to be able to produce more wheat from an acre of land than any other country. For the years 1898 to 1907 it has produced 32.6 bushels per acre, as against 13.9 in this country and 9.3 in Russia, which makes the poorest showing of the large wheat-growing countries. Germany leads in the yield of oats with 49.3 bushels per acre against 29.8 in this country. However, it seems very natural that the country having the largest tract under cultivation should have a poorer yield than those countries in which farming operations are carried on on a smaller scale and more particular attention can be given to the treatment of the land, so as to obtain the maximum product.

The crop estimate published in November was a preliminary estimate, and the final statistics for the year will be published while this issue of the Scientific American is on the press. The November figures are given below, showing a large increase over last year's figures in nearly every crop.

Crop.		Production (000 omitted).		
		1909 Preliminary.	1908.	Average, Five Years, 1903–1907
		Per Cent.	Per Cent.	Per Cent.
Corn	bushels.	2,767,316	2,668,651	2,587,877
Winter wheat	"	432,920	437,908	412,719
Spring wheat	"	291,848	226,694	237,791
Total wheat	"	724,768	664,602	650,510
Oats	"	983,618	807,156	870,251
Barley	"	164,636	166,756	148,155
Rye	"	31,066	31,851	30,006
Buckwheat	"	16,692	15,874	14,554
Flaxseed	"	25,767	25,805	26,121
Rice	"	......	21,890	......
Potatoes	"	367,473	278,985	289,400
Hay	tons.	64,166	70,798	60,671
Tobacco	pounds.	896,185	718,061	698,004

The above crops, which represent approximately 70 per cent of the value of all farm products, are this year in the aggregate about 2 per cent greater than in 1908, and 9 per cent greater than the average of the preceding five years.

Correspondence.

THE CHERRY MINE DISASTER.

To the Editor of the SCIENTIFIC AMERICAN:

In the SCIENTIFIC AMERICAN of December 4th, page 406, under the caption "The Cherry Mine Disaster," you say, among other things:

"On Saturday, one week after the accident, the miners who had walled themselves up in some of the galleries of the second vein were taken out after their long confinement, a living rebuke to the experts of the State Mining Commission and of the Technologic Branch of the United States Geological Survey, who had declared positively from the first that there were no living men in the mine, and that a day or two more or less made little difference."

It was with sincere regret that I read such a statement in a journal that has large influence among the intelligent people of the country. I fear that the statement you make will be largely believed, and that it will result in considerable injury to a movement which gives every promise of aiding materially in working out the causes of and of preventing mine disasters, as well as actually aiding in the rescue work following such disasters.

Whatever may have been the personal opinion of any of the government mining experts at the Cherry mine as to the probability of the entombed miners being alive in the mine at any time following the disaster, I am sure no such opinion was given out or in any way slackened their efforts—which were continued night and day—to reach the entombed miners, whether dead or alive. On the other hand, the mining engineers of the government and the members of the rescue corps were not only willing but insistent that the rescue work should go forward as rapidly as possible. Your correspondent's statement also does equal injustice to many State inspectors, who were doing everything possible to get into the mine with the same commendable purpose in view.

As you may know, the mining engineers of the government are entirely without authority for direct action in such rescue work. Their official work is that of investigations as to the causes of such disasters; but they were anxious to and did aid in every possible way in the work of opening up the mine with a view to saving life.

Their use of helmets for artificial breathing while penetrating suffocating mine gas was in several instances effective at this mine, as it has been in saving life at several other mine disasters. Such use of the oxygen helmets has on a number of occasions been of even greater service in preventing mine explosions, and extinguishing mine fires.

GEORGE OTIS SMITH, Director.
Washington, D. C. United States Geological Survey.

[It should be noted that our correspondent, who visited the Cherry mine, and informed himself fully in regard to the situation there, stated that experts of the departments made the statement referred to. Of course, such statements were entirely informal and unofficial, and it was far from the wish of the Editor to have it inferred that any negligence on the part of the departments had occurred. The admirable work of the Geological Survey is too well known to require any defense in our columns.—EDITOR.]

An Important English Patent Decision.

A patent decision which is of far-reaching importance to the mining world has been recently delivered in Great Britain by the House of Lords, which is the supreme legal tribunal. Mr. Alexander Stanley Elmore, of the United States, and the company exploiting his oil-acid process for the separation of ore by selective action, proceeded against Minerals Separation Limited, which he maintained were infringing his method. Both parties depended upon the selective action of oil for the success of their process, but Elmore contended that the pure use of oil did not achieve the desired result. In the course of experiments he claimed to have discovered that if a small quantity of acid were added to the liquid, the selective action of the oil was considerably enhanced, and in fact constituted the whole secret of the success of the process. This discovery he duly protected in a patent completed in 1901. Minerals Separation Limited, however, contended that the oil-acid process was not new, and furthermore argued that their own process was distinctly superior to Elmore's, inasmuch as instead of using from one to one and a half tons of thick oil per ton of ore treated, as advocated by Elmore, they only used from two to three pounds of thin oil for the same quantity of treated ore.

Elmore did not rigidly adhere to the patents he had secured prior to 1901, as it was ascertained that they lacked novelty; but he maintained that the addition of a small quantity of acid to the mixture of water, oil, and pulverized ore was a distinct discovery. Minerals Separation Limited also added acid to the solution. The first court decided that the 1901 patent was invalid and had not been infringed. Against this decision Elmore appealed, and the lower court's findings were reversed. Minerals Separation Limited consequently carried the matter to the House of Lords, and this supreme court has now pronounced definitely against the claims of the Elmore patent.

In the course of their judgment the Lord Chancellor stated that the 1901 patent specification was framed with great subtlety, narrative and claim being so closely interwoven as to render it difficult to decide how much of the narrative ought to be read into the claim. Disentangled, however, the specification turned upon the point that Elmore claimed the sole right to add any acid to the solution. No statement is made as to the proportion of this agent, this varying according to the character of the material treated. The Lord Chancellor stated that this latter factor is so wide that it sought to cover any known process of separating mineral substances by the selective action of oil and acid, and stated that he did not consider that Elmore had really discovered the enhanced effect produced by the addition of acid. For this reason he pronounced against the 1901 patent, and decided that no infringement had been made of Elmore's patent, in which decision the four other judges unequivocally concurred. This final decision has terminated a protracted litigation, and the Elmore claim cannot now be possibly sustained.

The Scientific American Aeroplane Trophy.

When the proprietors of this journal gave into the custody of the Aero Club of America their handsome aviation trophy nearly three years ago, it was with the belief that such a cup would help to create interest in the fascinating subject of human flight and would stimulate American inventors to renew their efforts toward its solution. It was at first thought advisable to hold contests upon a given date and at a stated place, and the first such contest was to have been held at the Jamestown Exhibition on September 14th, 1907, but as there was only one uncompleted aeroplane ready at that time, and as the announcement of future competitions did not meet with any response, it was decided to change the rules so that any experimenter could try for the trophy at any place provided he gave a few days' notice to the Aero Club so that the proper officials could be present to time and observe the flight. Under the new rules Glenn H. Curtiss made the required flight of a kilometer in a straight line at Hammondsport, N. Y., on July 4th, 1908, as a result of which he was declared the winner of the first leg of the trophy. Instead of requiring a specified distance for 1909, it was decided to award the trophy this year to the aviator who covered the greatest distance in excess of 25 kilometers over a closed-circuit course. On July 17th Mr. Curtiss made a new record of 24.94 miles in 52½ minutes above a triangular course at Mineola, L. I. This is the present record, and is the longest flight made in America by any aeroplane except the Wright. If it remains unbroken up to sunset on December 31st, Mr. Curtiss will have won the second leg of the trophy and will have to win it but one more year in order to hold it permanently.

As there are several new aviators who have been making successful though brief flights of late with their own aeroplanes, we believe that it would require but a little practise upon the part of some of these to enable them to surpass the present record. Flying an hour in December in the vicinity of New York should be no more arduous than automobiling for a like length of time, and when the prize to be won thereby is the first, the handsomest, and the most commemorative trophy ever offered in America, it is certainly well worth the attempt. We look for some budding aviator to send in his entry during the last days of the present year.

Nobel Prizes Awarded.

This year's Nobel prizes will be distributed as follows: For physics, divided between William Marconi and Prof. Ferdinand Braun of Strasburg; for chemistry, Prof. Wilhelm Ostwald of Leipsic; for physiology or medicine, Prof. Theodor Kocher of Berne; for literature, Selma Lageriof, the Swedish authoress.

The Nobel prizes, which are worth about $40,000 each, are awarded annually to those persons who are considered to have conferred the greatest benefit on mankind during the preceding year in the fields specified in the cable dispatch, with the addition of one for the best effort toward the fraternity of nations and the promotion of peace.

Prof. Ferdinand Braun is Director of Physics at the University of Strasburg. He was born at Fulda, Germany, on June 6th, 1850, and was educated at the University of Berlin. From 1876 to 1883 he was professor at the University of Marburg.

Prof. Wilhelm Ostwald, who received the Nobel prize for chemistry, was born at Riga in 1853. In 1887 he became Professor of Chemistry at Leipsic. As an investigator in connection with physical chemistry and chemical affinity he has become particularly well known. His researches have concerned, among numerous subjects, the electric conductivity of organic acids, and the color of ions. He has published several volumes on this and other scientific subjects.

Prof. Emil Theodor Kocher, who will receive the Nobel prize for physiology and medicine, is a Swiss surgeon. He is a native of Berne, where he was born in 1841. He was educated there, and after studying at Berlin, Paris, and London became Professor of Surgery in the university of his native city and Director of the Surgical Clinic. His especial field is the thyroid gland.

The Current Supplement.

Mr. Robert M. Strong's admirable comparison of the gasoline and alcohol engines is continued in the current SUPPLEMENT, No. 1772. Mr. Vaughan H. Wilson contributes an excellent note on the future of aluminium as a substitute for copper wire. Mr. George S. Hodgins writes on time speed control signals, in which he explains how the New York Subway trains are automatically controlled. In view of the difficulty experienced by the New Theater in New York city with its acoustics, an article by Floyd R. Watson should be of interest. The wonderful wine-growing and wine-pressing establishments of Kempinski & Co., the largest in Germany, are fully described and illustrated. Our Paris correspondent writes on the new electric locomotives for the Simplon tunnel. Action at a distance produced by drying oils is the title of an article by Werner Schmidt. He shows that many substances apart from radio-active substances affect the photographic plate. Among these is a class of so-called drying oils, the best known of which is linseed oil varnish. Mr. William H. Ballou contributes a popular article on some of the showy mushrooms in nature. In view of the return of Halley's comet, Prof. E. E. Barnard's contribution on photographing comets is most valuable.

Daniel's Comet.

Zaccheus Daniel of the Princeton observatory discovered a great comet on December 6 d. 599 Gr. M. T., in R. A. 6d. 16m. 30s. Dec. + 33 deg. 50 min. with a slow northerly motion. At the time of its discovery the comet was visible in a small telescope.

Prof. E. E. Barnard of the Yerkes observatory observed Daniel's comet December 7 d. 6605 Greenwich Mean Time, in R. A. 6h. 16m. 42s. Dec. +34 deg. 44 min. 22 sec.

At Smith College observatory, Northampton, Mass., Daniel's comet was observed on December 8 d. 5870 Greenwich Mean Time, in R. A. 6h. 16m. 57.6s. Dec. +35 deg. 30 min. 53 sec.

Metcalf reports Daniel's comet December 8th, 1909, at G. M. T. 12h. 30m., R. A. 6h. 16m. 52.5s. Dec. +35 deg. 27.6 min.

Continued Ephemeris of Halley's Comet.

A letter has been received at Harvard Observatory from Father G. M. Searle, C.S.P., of New York, giving the following "Continued Ephemeris of Halley's Comet. T assumed to be Apr. 19 d. 692 G. M. T."

Gr. Mean Noon 1910.	R. A. (1910.0) h. m. s.	Dec. Deg. Min.	Log. Δ	Br. (Sept. 11=1.)
January 2	2 14 37	+ 11 23.3		
January 4	2 7 50	+ 11 5.2	0.154	18
January 6	2 1 21	+ 10 47.8		
January 8	1 55 11	+ 10 31.1	0.165	18
January 10	1 49 21	+ 10 15.3		
January 12	1 43 49	+ 10 0.4	0.176	18
January 14	1 38 35	+ 9 46.4		
January 16	1 33 39	+ 9 33.4	0.188	18
January 18	1 29 00	+ 9 21.3		
January 20	1 24 38	+ 9 10.2	0.200	19
January 22	1 20 31	+ 9 0.0		
January 24	1 16 38	+ 8 50.6	0.212	19
January 26	1 12 59	+ 8 42.1		
January 28	1 9 34	+ 8 34.5	0.223	19
January 30	1 6 21	+ 8 27.6		
February 1	1 3 18	+ 8 21.5	0.234	20

Official Meteorological Summary, New York, N. Y., November, 1909.

Atmospheric pressure: Highest, 30.72; lowest, 29.48; mean, 30.16. Temperature: Highest, 74; date, 12th; lowest, 30; date, 25th; mean of warmest day, 62; date, 12th; coolest day, 32; date, 25th; mean of maximum for the month, 54.1; mean of minimum, 41.3; absolute mean, 47.7; normal, 43.9; excess compared with the mean of 39 years, 3.8. Warmest mean temperature of November, 50, in 1902; coldest mean, 37, in 1873. Absolute maximum and minimum of November for 39 years, 74 and 7. Average daily excess since January 1st, 1.0. Precipitation: 1.58; greatest in 24 hours, 1.0; date, 24th and 25th; average for November for 39 years, 3.38. Accumulated deficiency since January 1st, 4.44. Greatest precipitation, 9.82, in 1889; least, 0.75, in 1908. Wind: Prevailing direction, northwest; total movement, 9,232 miles; average hourly velocity, 12.8; maximum velocity, 48 miles per hour. Weather: Clear days, 11; partly cloudy, 11; cloudy, 8; on which 0.01 or more of precipitation occurred, 6. Snowfall: 1.0. Sleet: 23rd, 24th, 25th. Mean temperature of the autumn, 55.50; normal, 55.27. Precipitation of the autumn, 4.98; normal, 10.57.

THE NINTH ANNUAL LEPINE EXHIBITION OF TOYS IN PARIS.

BY JACQUES BOYER.

This year's Lépine exhibition of toys, like that of last year, contains many toys relating to aviation. Kites of strange designs, aeroplanes, and dirigible balloons are shown in great numbers.

Richer's "Modern War" represents an attack upon an airship, which carries a target consisting of two crossed flags. The projectile, which is shown in the center part of our photograph, is a small aeroplane made of wood and celluloid. It consists of a wooden spindle with a longitudinal slot for the reception of the wings. A screw propeller is attached at the stern. The projectile is launched by means of a pistol, the barrel of which also has a longitudinal slot through which the wings of the aeroplane pass. When the target is struck the balloon separates into two parts, as shown in the illustration.

The "Roulis-Bilboc" of the same inventor is a little billiard table mounted upon a spherical joint, which allows it to be turned and tipped in every direction. By the side of the table is a vertical support, on which slide three wires terminating in hooks, from which three balls are suspended at a determined height above the table. The game is played by means of a top, the upper part of which is hollowed out to form a hemispherical cup of a diameter equal to that of the balls. The player winds the top and sets it spinning on the table, which he then moves in such a manner, by means of the lever, as to bring the top directly under one of the three suspended balls, and then tips the table so as to catch the ball in the cup and remove it from its support.

The "Avion" and the "Mechanical Birds" of Le Dantec are aeronautic novelties. The "Avion" is supported, propelled, and steered entirely by screw propellers driven by turbines. The "Avion" itself is formed of an assemblage of metal tubes which support a horizontal frame. This frame carries two horizontal propellers for support and ascension, and three vertical propellers, one for propulsion at one end of the axis of the flyer and two for steering at the other end, the axes of these being at right angles to that of the large one. Above this frame is a plane surface having two circular openings immediately above the lifting propellers, and four valves in the form of rectangular doors, hinged at their front edges, which open and allow the air to pass during the ascent of the "Avion," but close as soon as it begins to fall. All of these propellers are driven by explosion turbines of a type invented by M. Uhlenhuth.

The "Fil-Vit" is a self-starting aeroplane, three forms of which are shown in one of the photographs. Part of the flight is accomplished by means of screw propellers driven by stretched rubber bands, the other part by soaring. One of the types is a Wright biplane with two propellers at the bow. It rises from the ground by its own effort, and accomplishes a flight of fifty yards. Another is a monoplane with one bow and one stern propeller, which also rises unaided and flies fifty yards. The third is a biplane with two bow propellers, which rises after running two yards on the ground and makes a flight of one hundred yards, gradually rising to a height of five yards.

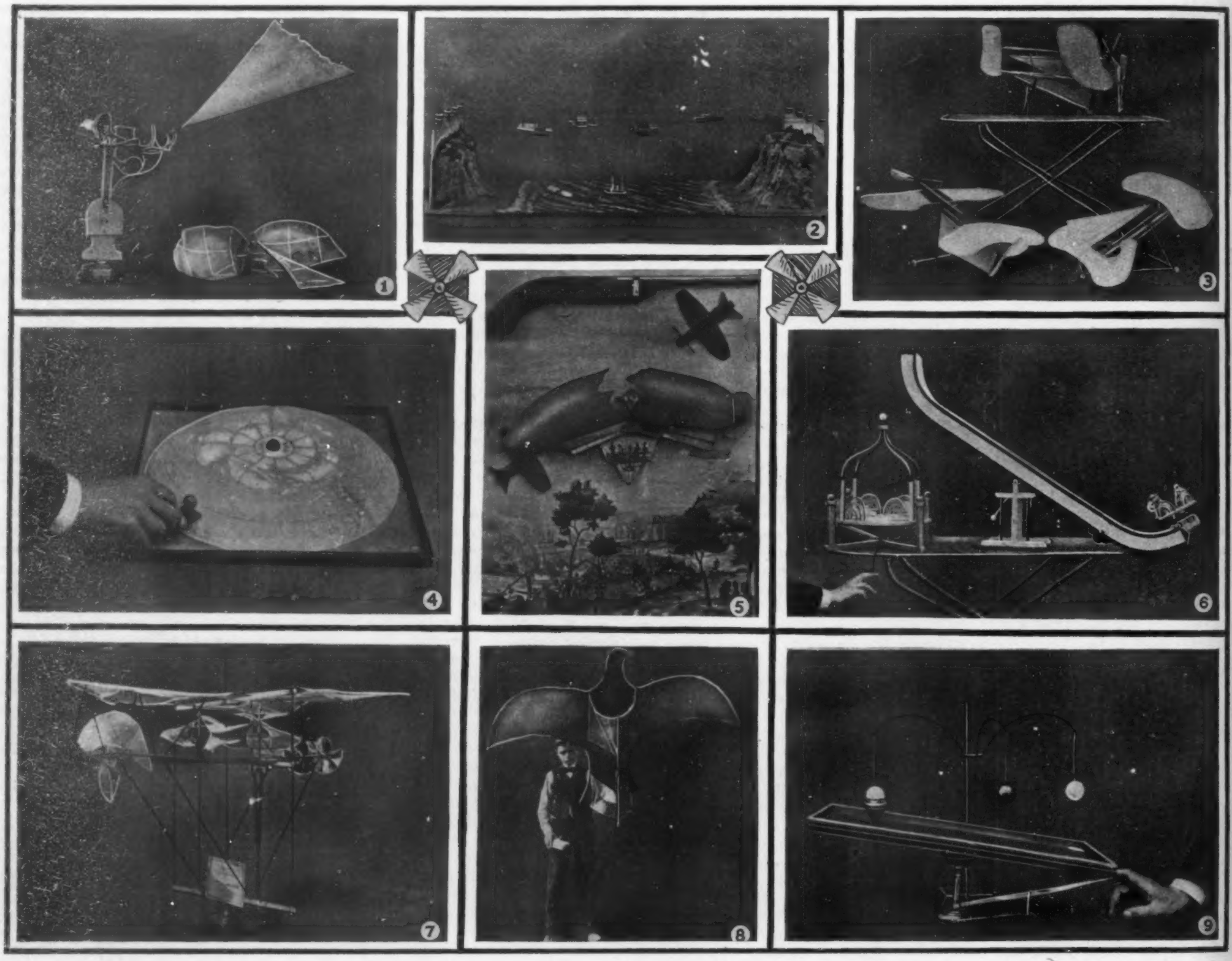
Blin's "Crossing the Channel" is a simple but novel and attractive racing game. Starting from the French coast as Blériot did, the aviators, represented by little paper figures, endeavor to reach the cliffs of England. The aeroplanes are attached to elastic cords, which are stretched between pulleys on the two coasts. Each player, by turning his pulley, causes his aeroplane to advance, but also produces vibrations which frequently result in a fall into the sea, which for the sake of realism is dotted with little vessels.

The "Aigloplan" is simply a large kite representing an eagle. The frame is formed of whalebone, steel, and bamboo. The wings and head of the bird are rigid planes, and the body is represented by four rectangular pieces of very stiff canvas. The lifting power of the kite is sufficient to make it available for experiments in aerial photography and wireless telegraphy, and its constructor, M. Gueneau, uses it for advertising purposes. The largest of these kites can carry a banner measuring 10 by 30 yards. These great birds of prey have for some time been seen soaring majestically over the Paris boulevards.

Clément's "Whirlwind" is simply a seesaw having curved ends and a longitudinal grooved channel in which a car moves. The "Leaping Plate" (shown on the left of Fig. 6) is a platform resting upon four springs, which can be depressed more or less by pulling a cord. On the platform is placed a ball which, by operating a cord and thus tipping the platform, is caused to strike and knock down little puppets, seated on benches around the edge,

Blin's "Polar Billiard Table" represents, in relief, the scene of the recent exploits of Cook and Peary. The North Pole is represented by a small depression. The convex polar region rests upon a square table with a raised edge. The game is played by four persons, and consists in pushing a pith ball, with the aid of a flat wooden blade, up the convex surface and into the hole at the pole. The rotundity of the surface and the flatness of the blade conspire to make this task more difficult than it might appear.

These are some of the most striking novelties to be seen at the Ninth Lépine Exhibition. Many others might have been included if space allowed. For example: "The Luminous Flames," a game of skill which is enlivened and adorned by miniature electric lamps, many very curious toys, safety hat pins, automobiles, boats, locomotives, and other artistic and original creations which demonstrate the skill and activity of the members of the "Société Française des Petits Fabricants."



1. The "Mechanical Bird" and its propeller. 2. The Flight Across the Channel. 3. The "Fil-Vit." 4. The North Pole Game. 5. "Modern War." 6. The "Whirlwind." 7. The "Avion." 8. The "Aigloplan." 9. The "Roulis-Bilboc."

STRIKING TOYS AT THE NINTH ANNUAL LEPINE EXHIBITION, PARIS.

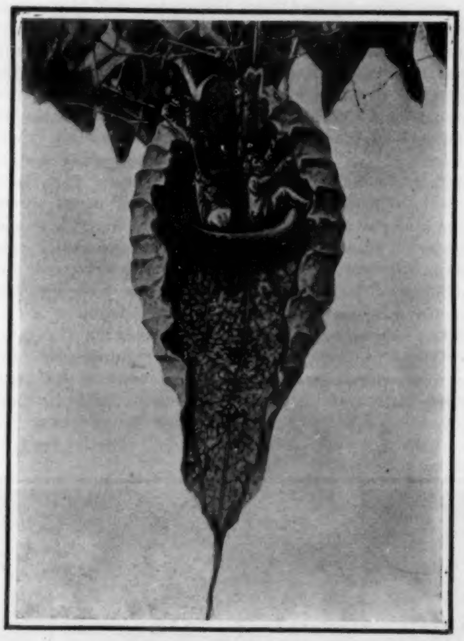
Petroleum as a disinfectant for checking the spread of plague is advocated by some medical officers in India. It is pointed out that during the pestilence that swept Europe long ago the oil regions of Baku were untouched, although in the surrounding country 50 per cent of the population perished. Lerche, who visited Baku in 1735, wrote: "It is quite likely that the fact that the Black Death did not touch Baku was due to petroleum."

CARNIVOROUS PLANTS OF THE FUTURE.

BY S. LEONARD BASTIN.

It is a fact recognized by botanists as beyond dispute that the carnivorous habit among plants is more widespread than it was formerly supposed to be. The specialized sundews (Droseras) are but the advance guard of a large army of species which depend for their existence more or less upon the absorption of animal salts through their foliage. There is no gainsaying the statement, recently put forward by more than one scientist, that the tendency to rely upon a carnivorous diet is on the increase. Of course, this is only in a line with the simplest evolutionary principle. It is possible to trace the steps by which the highest types of species, which seize and hold their prey, such as the Venus fly trap (Dionæa), have been evolved from those which merely capture their victims by the use of an adhesive fluid, such as the fly catcher of Portugal (Drosophyllum). Still lower in the scale are the plants, such as the teasles (Dipsacus), which drown the insects in strange bucket-like contrivances located at the base of the leaves. Flies which may chance to fall into the water are of course drowned, and the plant absorbs the nitrogenous elements from their decaying bodies.

It is a startling conception that in ages to come the plant world as a whole may become so advanced in carnivorous tastes as to be a real menace to animal creation. Dreadful indeed must be the sundews and the Dionæas to their insect victims at the present time. The unfortunate fly which is captured by the leaf of the sundew finds itself held down by strong arms which are able to resist its violent struggles. The largest Drosera on earth at the present time produces leaves which are perhaps nine inches in length. Magnify this plant until the leaves are ten feet in length, and we have an exceedingly formidable specimen. Many of the palms and other tropical species have foliage which is much in excess of this measurement, so that the idea of leaves as big as this is not altogether fantastic. To be in proportion, the tentacles could scarcely be less than ten inches in length, and these would be able to grapple with birds of considerable size. We may conceive that the giant sundew would be able to hold out some special inducement for its intended victims to visit the leaves. Probably the bait would be in the form of some sweet-tasting secretion. On alighting, the birds would probably not find the adhesive fluid which the leaves would produce more than slightly annoying. The movements which they would make, in an endeavor to free themselves, would be all-sufficient to give the stimulus to the sensitive tentacles. These would rapidly close in on their prey, and in a few moments escape would be out of the question. Finally, the unfortunate birds would perish miserably, the bodies in their decay yielding to the plant the nitrogenous matter desired.



Possible enormous aristolochia flowers of the future which may lure even men.

The Pinguiculas or butterworts are at the present time innocent-looking plants rather attractive in appearance. These species, as is well known, find their home in boggy tracts, where they spread their foliage on the surface of the ground in the form of a rosette. If the leaves of the butterwort are closely examined, it will be seen that they are thickly covered with two sets of glands, one set of which is plainly visible to the naked eye. This visible set resembles a miniature mushroom, while the other set is microscopic and is formed of eight cells grouped after the manner of a wart or a knob. It is the practice of these glands whenever they come into contact with any object to pour out copiously a mucilaginous fluid, which acts much in the same way as bird lime. Acid secretion is also produced, which aids the leaf in the digestion of the object—supposing that the capture should be an insect. In order to make assurance doubly sure, the

(*Continued on page 477.*)

The great bladderwort swallowing a reptile.

A man-eating Venus fly trap.

From a giant pitcher plant a man could escape only with the help of a friend.

A goat-eating butterwort of the future.

A great sundew, millions of years hence, catching a stork.

CARNIVOROUS PLANTS OF THE FUTURE.

THE MOST ANCIENT OF HUMAN SKELETONS.

In February, 1909, the skull of one of our most ancient known ancestors was found at Chapelle aux Saints, in the French department of Corrèze. In September a nearly complete skeleton of approximately equal antiquity was exhumed at Ferrassie, in the department of Dordogne, by Dr. Capitan and M. Peyrony. The strata which covered the skeleton were absolutely intact and the exhumation was performed so carefully that the bones were revealed in the precise positions in which they had been laid to rest, at least 20,000 years ago. This is the first instance in which so ancient a skeleton, found in such well-marked and indisputable geological surroundings, has been photographed at the moment of exhumation and before it had been disturbed.

The region surrounding Ferrassie is peculiarly rich in prehistoric human remains and documents. Ten miles eastward are the famous caves of Eyzies, where the oldest known drawings on bone, ivory and horn were discovered nearly fifty years ago. In the neighboring cave of Cro Magnon, Lartet and Christy, in 1858, discovered portions of five skeletons and two skulls which have recently been determined to belong to the Aurignacian race, a less ancient race than the Neanderthal, to which the Corrèze skull and the Ferrassie skeleton appear to belong. The same region includes the terraces of Monstier where chipped flint tools of peculiar character were found in 1863. The name monsterian has been given to the period of these tools, which succeeded the acheulean and its predecessor, the chellean, the most ancient division of the quaternary. Relics of the cave dwellers have been found at various other points in the vicinity.

This region has yielded, and will continue to yield, more human documents than any other part of France, for the following reasons: During the monsterian period of the stone age the region was covered with prairies and forests and abounded in horses, cattle and deer, which, with the fish of the Vézère River and its tributaries, furnished a plentiful supply of food. Probably reindeer could also be found on the hills. Furthermore, the river valleys are bordered by chalk cliffs and terraces, often overhanging, and honeycombed with caves, hollows and fissures, which formed excellent shelters. The deeper caves seem to have been reserved for funereal and religious uses, while savages dwelt in the shallower caves and, especially, beneath overhanging cliffs in front of which screens of boughs were constructed. A region which offered such advantages in regard to food and shelter must have been very popular in a primitive age.

On the other hand, it is certain that the general topography of the region has undergone little change since the monsterian period. No geological convulsion has occurred. The principal change is a deepening of the valley by about 30 feet, and this has further isolated the land at the base of the cliff, which was already well protected from inundation. Men doubtless dwelt on the plains also, in those remote times, but all vestiges of them and their works have been destroyed or washed away by floods. Finally, all bodies buried in places distant from human habitations were quickly devoured by the hyenas which then abounded in France, and during the centuries that followed, the pick and the plowshare completed the destruction of the few bones that remained. This is the explanation of the exceedingly rare occurrences of very ancient human bones in most regions and their comparative abundance in Dordogne.

The Ferrassie skeleton was discovered in the course of exploring a mass of debris about 100 feet long, sloping upward from the road to a low chalk cliff rising a few yards above it. The width of the mass varied from 30 to 60 feet and its height, at the cliff, from 15 to 30 feet. The appearance of the superficial layer and the fissures of the cliff indicated the fall of an overhanging cliff, which should have formed an extensive shelter at a much earlier epoch. As this view was confirmed by the discovery of chipped flints where the edge of the mass was cut by the road, explorations were undertaken several years ago, but nothing of especial importance was unearthed until recently. The excavation was begun by digging a broad trench from the road to the cliff in order to allow the mass to be removed in successive horizontal layers. Last September two bones were seen slightly projecting from the wall of the trench, near the bottom. On removing a little earth the bones were recognized as a human tibia and femur. The earth over the bones was then removed, by horizontal layers, with extreme caution. When the greater part of the monsterian stratum had been removed, three flat stones, about eight inches square, covering the skull and parts of the arms, were discovered. The reddish brown sand which surrounded the skeleton contained many large splinters of bones of animals which showed marks of hammering. Very slowly and with infinite precaution the skeleton was laid bare without displacing a single bone. It lay on the back, with the trunk turned slightly to the left, and the legs sharply bent back under the thighs, which were half flexed on the pelvis. The knees were turned to the right. The left arm was extended beside the body, with the hand at the hip, while the right arm was bent, and the hand near the shoulder. The head was turned to the left, with the mouth wide open.

The bones, though broken in places by the great weight of the earth above them, remained firm and in their normal positions. Only the bones of the right hand and foot had been displaced, and in part removed, probably by rodents or small carnivora.

THE MOST ANCIENT OF HUMAN SKELETONS.

The skeleton was photographed as it lay and the leg and arm bones were carefully removed. The pelvis was then covered with tinfoil and a large plaster cast was formed around it, so that it could be taken up without injury. The thorax and the skull were treated in the same way. Hence these parts can be mounted without the loss of a single fragment, as the earth in which they lay will surround them, inside the plaster casts, until the casts are opened in the preparing room. This method is commonly employed by palæontologists, but this is its first application to human remains.

The age of the skeleton is indicated, with certainty and precision, by the regularity and very characteristic appearance of the successive strata of the mass in which it was found. (Age, in prehistoric chronology, refers, not to a definite number of years, but to a period of more or less hypothetical duration.) The quaternary geological period, in which man appeared on earth, began with the comparatively warm chellean age, which has left remains of the rhinoceros, hippopotamus, and elephant, and flint tools scarcely modified by man. Then came the cold acheulean age, the age of the mammoth, marked by crudely chipped flints. The ensuing monsterian age, at first cold but subsequently mild, represents a higher civilization possessing a variety of more elaborate flint tools—daggers and picks, knives and scrapers, and disks of unknown use, very characteristic of the age. Flints of all of these types were found around and above the skeleton, while ruder acheulean flints were found beneath it. Hence the skeleton is monsterian.

The stratum containing the skeleton was covered by two strata containing flint tools of the aurignacian age. The overhanging cliff then fell, and its debris subsequently became covered by a layer of earth and stones, five feet in depth, which has effectually protected the human relics beneath.

Dr. Capitan believes that the skeleton is that of a corpse regularly prepared for sepulture, which may have been covered with earth, but was not buried in a grave. Protected by the vicinity of the living inhabitants of the shelter, the skeleton escaped the hyenas and was only nibbled by small animals. This unique skeleton, which is at least 20,000 years old, will probably be mounted and exhibited in the Museum of Natural History at Paris.

A New Substitute for Cotton.

The busy town of Chemnitz, the largest manufacturing center in the kingdom of Saxony and one of the largest factory towns of the German empire, has just witnessed the birth of a new invention which will doubtless cause considerable changes in the price of cotton and which, furthermore, will be of interest and importance to our readers in kapok-growing countries.

For some considerable time past the German textile world has been devoting unflagging attention to the discovery of fibrous plants which might in any way be rendered available as a substitute for cotton, and great interest has been given to the different more or less successful experiments made. Trials made with ramie and caravonica have been fairly successful, but have not met with that meed of success, nor attracted so much attention, which has fallen to the share of the experiments made with the fiber of the kapok tree (the so-called "silk-wool tree") which flourishes in America, Asia, and Africa. The fruit of this tree contains a seed which, like that of the cotton plant, is enveloped in soft silky hairs. These hairs, however, are so short that they have hitherto been useless to cotton spinners and have been used chiefly for upholstery and mattress-making purposes. Most kapok trees grow wild, and only recently have a few Europeans begun to cultivate them systematically in New Guinea and East Africa. Steps are also being taken to grow these trees properly in the German protectorates.

This new industry will be greatly favored by the process just discovered by a large German spinning mill, whereby it is now possible to render kapok fiber easily spinnable. So far, as an absolute matter of fact, the veritable fiber of the kapok tree has not been dealt with, but only the fibers of the *Calotropis procera* (a plant growing wild in East Africa); however, it is exactly the same as kapok fiber in character, appearance, and qualities. Hence, if the one can be spun, so can the other—a point on which not the slightest doubt is entertained. By means of a process evolved by Prof. Goldberg of Chemnitz, the brittle and fragile fiber of the kapok tree is treated in such a way as to render it easily spinnable, and yarn up to No. 12 English is now being spun from it. A sample, both of the raw material and of the yarn, may be seen at the offices. As will be seen, the yarn is of fine quality and of a very soft, silky, and tenacious character. The process in question does not necessitate the employment of any new machinery, but is based entirely upon a novel and somewhat complicated system of preliminary preparation and spinning. What the actual process is cannot yet be divulged.

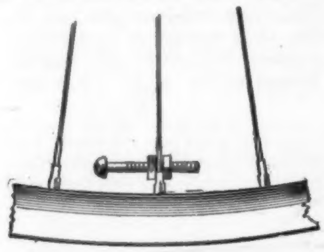
In the German African colonies fiber stuffs of all kinds are now being grown and, as Dr. Hindorf recently pointed out in a report to the Kolonial-Wirtschaftliche Komité, the new plantations of sisal in German East Africa have now attained such dimensions that in a few years time the annual output will exceed 10,000 tons, and Germany will be able to meet her own requirements. Togo appears highly suitable for the cultivation of sisal, and trial plantations are also being laid down there. Kapok is also grown in

(Concluded on page 479.)

IMPROVED NIPPLE GRIP.

BY THOMAS DE LOOF.

When one wishes to replace a few broken spokes in a bicycle wheel, he often finds that he has no nipple grip, while a bicycle wrench proves to be too long to get in around the spokes. A good nipple grip



IMPROVED NIPPLE GRIP.

can be made by putting two nuts on one bolt, as shown in the accompanying engraving.

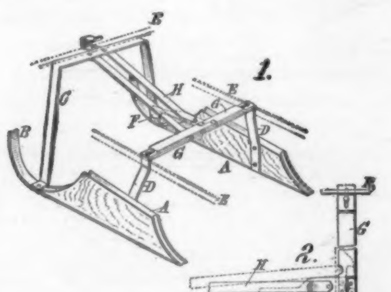
HOW TO WATER-PROOF CLOTH.

For rain coats or other water-proof clothing, woolen goods having a close weave are the best. Use goods in which the face is smooth and firm, although cloth having a soft face answers fairly well, provided the weave is tight and close. To water-proof the cloth, lay it out on a large table face up. Then take a block of paraffine about six inches square and rub it all over the face of the cloth, bearing down hard. This will leave a thin film of paraffine on the face of the cloth. Melt this film of paraffine into the goods, using a flat iron that is just warm. Too hot an iron will set the paraffine on fire and burn the goods. It is well to experiment with a small sample first, and learn how to do the water-proofing properly before starting in with a pattern of goods. To determine when the sample is properly water-proofed, hold it in a kind of bag, with the face in, and pour in some water. If the water-proofing has been properly done the water will not wet the face of the cloth, but it will stay in globules and act as if it were on a greased board or hot stove.

SLED RUNNER ATTACHMENT FOR GO-CARTS.

BY MILTON STONE.

The writer made a pair of runners for his go-cart last winter which proved quite a success. They were made of 1-inch by ⅛-inch iron, and weighed altogether six pounds. The construction was such that they could be applied or removed in a few seconds. Referring to the accompanying illustration, it will be seen that two wooden side pieces *A* were provided, to which the runners *B* were fastened. The wooden side pieces were cut out and grooved to receive the wheels, and the runners were curved up to fit against the front



SLED RUNNER ATTACHMENT FOR GO-CARTS.

wheels. A U-shaped frame *C* of strap iron connected the runners at the forward end, while they were connected at the rear by a second and lower frame *D*. The frame of the go-cart is indicated by dotted lines at *E*. A pair of sliding members *G* were fitted onto the U-frame *D*, and attached to a lever *F* in such manner that they could be extended over the side bars *E* after the go-cart was fitted over the runners. A strap *H* extending forward to the frame *C* was formed with a hook, so that when the lever *F* is moved to extend the members *G*, the strap *H* is retracted, causing the hook to fit over the front cross piece *E* of the go-cart frame. In applying the runners to the go-cart, it is merely necessary to raise the front wheels so as to clear the side pieces *A*, and then move the cart into position, after which the lever *F* is moved to lock the runners fast. One of the advantages of this system is that the runners at the rear are so short that when the cart is tilted backward the wheels rest on the ground, and in that position they can be wheeled over any bare spots.

A SNOW-BOUND SANTA CLAUS.

BY JOHN A. BERGSTROM.

The accompanying illustrations show how a very pretty effect may be obtained in Christmas tree decoration. It has the appearance of a Christmas tree in a snow storm.

Stretch a cord above and in front of the Christmas tree with one end fastened to a hook or a nail and the other end to the armature of an electric bell. Hang from this cord a number of fine threads to which at intervals small pieces of cotton are fastened. The bell is connected up to a battery with a push button in the circuit. When this button is pushed, causing the armature and cord to vibrate, the quivering bits of cotton look like falling snow. The armature of the bell should be bent back a little so as not to strike the bell, which may be covered up with a wreath or other decoration.

Fig. 1 illustrates how the cotton may be attached to the threads.

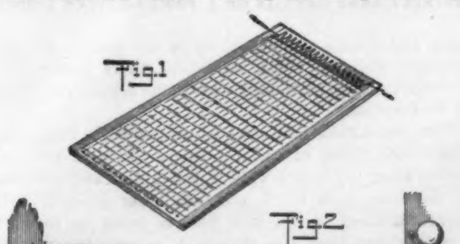
A frame is first made a little longer than the cur-

SANTA CLAUS IN A SNOW STORM.

tain. This may be made out of any kind of rough lumber and nailed together. At one end of the frame two rows of pins are put, about ½ inch apart. The pins in each row should be about ⅛ inch apart. At the other end of the frame is put another row of pins ⅛ inch apart.

Now wind the cord around the two rows of pins and fasten the ends, as shown. Then fasten the end of a fine thread to the cord at the first pin. Bring the thread down to the lower end of the frame and wind around two pins, then back again and fasten to the cord. Repeat until the required number of threads are obtained. Now take a fine brush, preferably a painter's striping brush, and apply glue to the threads, crossways, about two inches apart, the whole length of the curtain.

Cut some thin cotton batting into strips about ⅛



APPARATUS FOR PRODUCING THE SNOW STORM EFFECT.

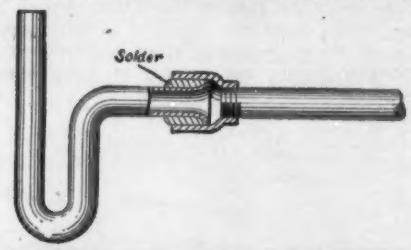
inch wide, and place them across the threads where the glue has been applied, pressing them down onto the threads.

When dry cut the lower ends of the threads and pull each individual string away from the rest. Just enough cotton will stick to each string. After all the strings have been separated remove the cord at the upper end of the frame and the curtain is ready to be hung up. Fig. 2 shows a part of the curtain when finished with threads about 1 inch apart.

HOW TO MAKE LEAD PIPE INTO IRON PIPE WITHOUT A WIPED JOINT.

BY HOWARD H. NICHOLS.

It takes a skilled plumber to make a lead pipe into an iron pipe, using a wiped joint, but using the following method any mechanic can make a permanent joint



SIMPLE METHOD OF CONNECTING LEAD AND IRON PIPE.

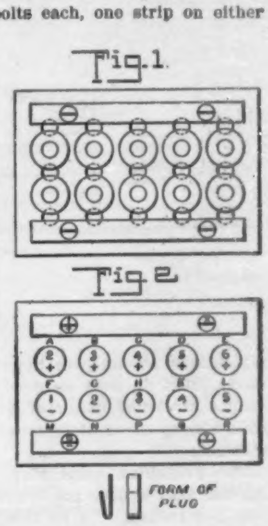
which is equally as good as a wiped joint. The accompanying drawing shows a lead *S* made into a galvanized-iron pipe. The large end of a reducing coupling is placed over the end of the lead *S*, and the end is then flared out with a blunt piece of steel, so that it will flare out and fit the coupling snugly, as shown. The space between the lead pipe and the coupling is then filled with hot solder, which is allowed to round out on the pipe and make a smooth joint. To complete the job, the iron pipe is then screwed into the small end of the coupling.

A METHOD FOR CONNECTING BATTERIES IN COMBINATIONS.

BY CHAUNCEY W. NIEMAN.

The inventor who deals much with electricity is bound to find himself sooner or later greatly hampered in experiments with batteries by the necessity of frequent changing from parallel to series, etc. It is one of the little routine details which makes most of the worry in experimenting, for the connecting up of a dozen wires may often cause the loss of a happy "inspiration." A convenient and easily made switchboard is illustrated herewith, and it will add its mite of comfort to the harassed inventor. This board, for six batteries, allows all possible connections, and by adding more points can be adapted to any number of batteries.

It is made as follows: The "board" is a one-inch piece of wood, mounted if desired on feet. In this bore ten holes, to receive an equal number of stove bolts, as per plan in Fig. 1. The bolts should be provided with large washers, and the holes so bored as to allow a distance of ⅛ inch between the washers when in place. Next two metal strips should be fastened by two stove bolts each, one strip on either side of the rows of bolts. The distance between the strips and the edges of the washers should be ⅛ inch also. At the points indicated by the dotted circles bore ⅜-inch holes half way through the board. Plugs should then be made, and consist of strips of sheet copper or brass, ¼ inch broad, bent as shown. Wires are then led from each pole of every battery and connected underneath the board to the bolts.



A SIMPLE BATTERY SWITCHBOARD.

The wiring diagram is given in Fig. 2. Batteries are numbered from 1 to 6, and the positive and negative of each battery are connected to the bolt so marked. Current is taken off at the points *X* and *Y*. An understanding of the key given below will enable anyone to make the combinations indicated with great speed and almost no trouble.

Insert plugs at	to obtain
F, G, H, K, and *L*	all in series.
C, F, G, K, L and *P*	2 parallel sets of 3 in series.
B, D, F, H, L, N and *Q*	3 parallel sets of 2 in series.
A, B, C, D, E, M, N, P, Q and *R*	all in parallel.

POWER-DRIVEN SCOOTER.

BY FREDERICK K. LORD.

In the issue of January 9th, 1909, there appeared plans for a scooter, with description of how it should be built.

The accompanying illustrations show how this scooter may be converted into a sort of automobile ice boat or auto scooter.

The motor should be preferably an air-cooled one, but as it may be difficult to get an outfit of ample power without high cost, a water-cooled motor is shown in the plan, as it is cheaper and there are a great variety to select from. It will probably be necessary to experiment with the water system. The plan contemplates a thin flat tank with a large cooling surface to act as a radiator. If the weather is very cold this may be sufficient; if not a simple radiator may be made by passing the water through thin copper tubing, coiled in a spiral. A seven-horse-power motor, as shown, weighing about one hundred and seventy-five pounds and running at seven hundred revolutions, should give the scooter a speed of about thirty miles an hour on good smooth ice. If a lightweight air-cooled motor of twenty horse-power is installed a speed of sixty miles an hour can easily be obtained.

The propelling outfit may be installed in such a manner that it does not interfere with the use of the boat for sailing. To do this it is only necessary to shift the gasoline tank forward and make the driving wheel case watertight, the same as a centerboard trunk. The steering runner could have a removable pin through the stock at the tiller head, thus allowing the runner to be unshipped. If the wind died out one could "auto scoot" home by simply putting in the rudder and starting up the motor. Of course the extra weight and windage of the sails and rigging would retard the speed somewhat.

The first step in construction is to put in the trunk in which the driving wheel runs. First cut a slot in the bottom 13 inches long and 3 inches wide to allow the wheel to touch the ice. The forward point of the slot is 5 feet 5 inches from the bow, if the boat is built accurately to the plans.

The old floor timber at station No. 7 will have to be cut amidships and a short one put in about two inches farther aft in order to allow sufficient space for the driving wheel.

The two trunk posts are now put in. These are of oak; the forward one is 2½ inches wide and 2½ inches thick. It is jogged out as shown in the plan so that it rests on floor No. 5 and supports the deck beam. The post must be securely bolted to both floor and deck beam, as a large part of the strain comes upon it. The after post is 2½ inches by 2 inches, securely fastened to floor No. 7.

The sides of the trunk are of white pine ¾ inch thick, and put on two pieces to a side. The joint should come in line with the wheel bearing, and be cut out around it to allow play for the driving wheel, as it jumps over rough ice. The lower boards should land on top of the bottom and be fastened to it with brass screws put in from underneath. If the posts and boards are well fitted to the bottom and set in white lead the trunk should be fairly water-tight. A removable cap of ¾ inch white pine allows the trunk to be inspected.

The wheel yoke may next be shaped out. This comprises two pieces of oak 1¼ inches thick, 2 feet 2½ inches long, 4½ inches wide in the middle and 3 inches at the ends, with a 1¾ x 3 inch cross piece to hold them together. A 1¾-inch hole is bored in them, 1 foot 2 inches from the after end, to take the flanged bearing of the driving shaft. Fig. 2 shows the lay-out of the yoke and trunk, also the little ½-inch oak strips *AAA*, which keep the yoke from chafing the sides of the trunk.

The driving wheel is of 1½-inch oak, 15½ inches in diameter. The rim is rounded over and fitted with twelve spikes. These can be made from 2¾-inch iron lag screws. Bore holes in the rim and screw them in. Then cut their heads off with a hack saw and file them to a chisel point at an angle of about 45 degrees, as shown in the upper portion of Fig. 4.

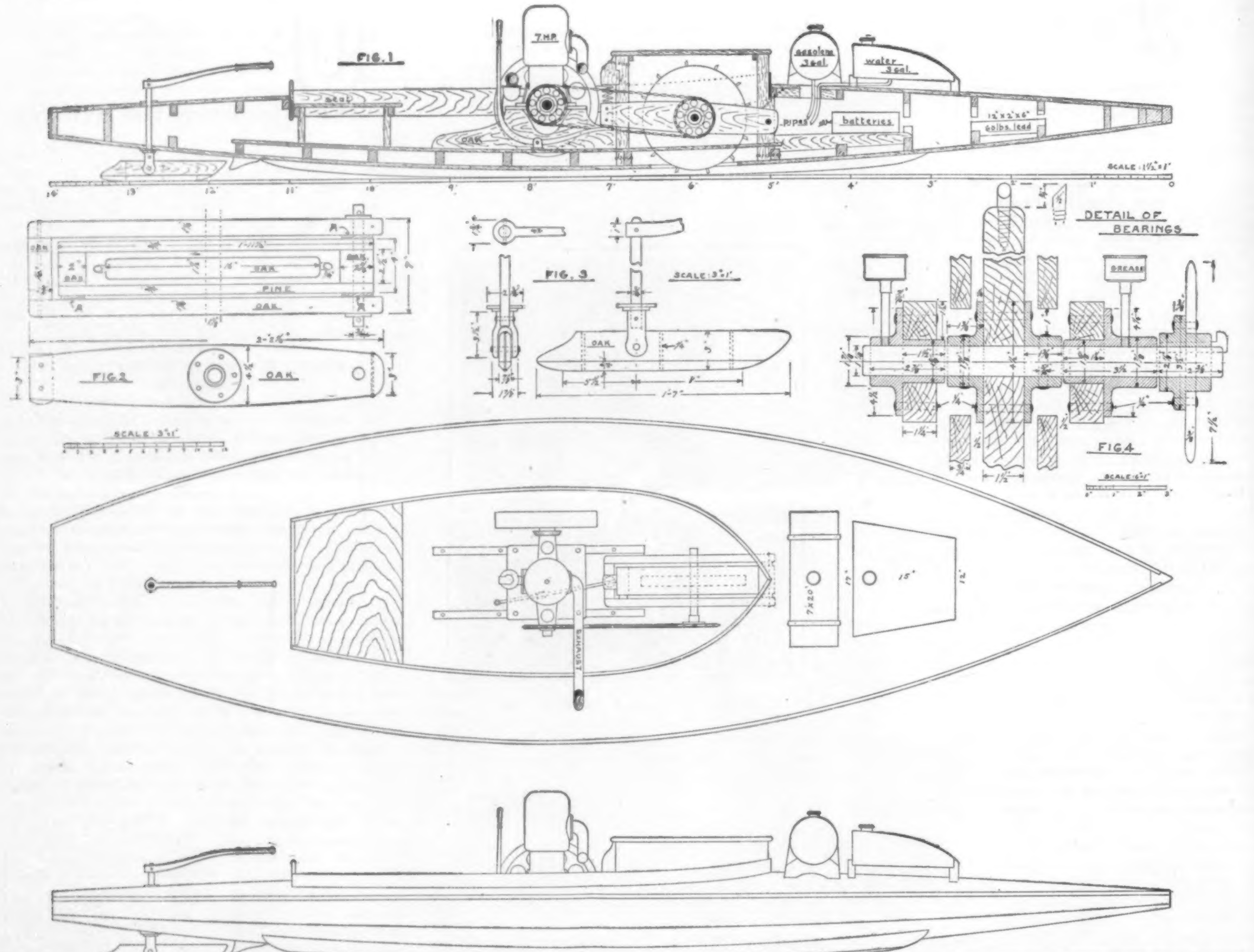
The same figure shows in detail the flanges and bearings for carrying the wheel and delivering the power. The flanges should be bronze castings turned and fitted on a lathe. The cheapest way is to make one pattern large enough to enable all the flanges to be worked down from it. This would not be very expensive, but the flanges must be well made or else trouble will surely ensue. The driving shaft is of 1⅛ steel, 14 inches long. A 7/16-inch driving sprocket about 7½ inches diameter is riveted to the flange and then keyed on to the shaft. As Fig. 4 shows clearly the dimensions of flanges and rivets, it is not necessary to describe them in detail. The driving wheel is pinned to the shaft with two 5/16-inch taper pins driven in tightly and riveted enough to prevent working out. A couple of grease cups are put in as shown.

To put the outfit together first pin the driving wheel on the shaft and lay it in the trunk, the two upper side boards being, of course, removed. Fasten the two bearing flanges on the yokes and then slip each side over the shaft. The yoke is now fastened together at the rear end by two ¼-inch through bolts, as shown in Fig. 2. The forward end has a ¾-inch pin passing through the oak post tightly and having two washers and pins to keep the yoke together. As the thrust of the motor is taken on this pin be careful to get it to fit the wood tightly. A small through rivet forward of the pin will help prevent the wood from splitting. The sprocket may now be keyed on and grease cups fitted. As the driving wheel will move up and down, due to bumps in the ice, it must be made flexible. This is accomplished by means of the movable yoke and a spring fitted at the after end of the yoke to keep it pressed down hard on the ice and prevent the teeth from slipping.

An oak block is fastened securely to the trunk post and a 3/16-inch spring about 1½ inches in diameter and 4 inches long should be about right. Drive nails in a row around the spring to keep it in place.

A means must be provided for raising the driving

(*Concluded on page 479.*)



CONSTRUCTIONAL DETAILS OF A POWER-DRIVEN SCOOTER.

RECENTLY PATENTED INVENTIONS.

Of Interest to Farmers.

GATE AND DOOR FASTENER.—F. J. S. MIELY, Gunnison, Col. In this patent the purpose of the inventor is to provide a novel, simple device for securing a door, gate, or the like in closed condition, the fastener being durable, and convenient to operate. The fastener is very desirable for use in the closure of an opening in a fence through which cattle are driven from one inclosure to another.

Household Utilities.

CANDELABRUM.—O. H. VAN GUELPEN, New York, N. Y. The candelabrum is so constructed that its arms can be turned around a central support, and the arms are so jointed and connected that their members can be placed in any position in relation to each other, and fastened in adjusted position, the adjustment being done with ease at the back or front of the device.

ANTISEPTIC TOOTH-BRUSH HOLDER.—W. D. JONES, New York, N. Y. The holder is arranged to contain the brush in a tube filled with antiseptic vapors, to allow convenient removal of the brush for its legitimate use and replacing of the same in the tube, and to supply the latter continually with vapors to maintain the brush when not in use in an antiseptic condition.

Machines and Mechanical Devices.

MACHINE FOR SHEARING METAL SHEETS.—G. B. JOHNSON, 8 Victoria Street, Westminster, London, England. This machine facilitates and reduces manual labor incidental to the accurate shearing of sheets to a rectangular form, and is designed to overcome difficulties in such operations when performed by a single shearing cutter to which the edges of the sheet are successively presented, and more especially when it is required to simultaneously cut a number of roofing sheets in the "pack" as the latter is delivered from the rolling mill.

NOTE.—Copies of any of these patents will be furnished by Munn & Co. for ten cents each. Please state the name of the patentee, title of the invention, and date of this paper.

Legal Notices

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Fastening for loops and the like, Jones & Stewart 942,330
Fence brace, G. Schneider 942,502
Fence post, metallic, E. C. Kahn 942,369
Fence, snow, H. J. Schweitzer 942,147
Fence wire clamp, Grayson & Hentz 942,064
Fender, A. W. Shank 942,290
Fibers, threads, and fabrics, improving textile, G. Kraemer 942,395
Figure, jointed sheet metal, F. C. Sneyd 942,524
Filing cabinet, J. R. Ryan 942,414
Filter, J. T. H. Paul, reissue 13,053
Filter press, E. W. Heller 942,173
Fire escape, J. B. Albert 942,477
Fire escape, L. Vogl 942,604
Floor dressing machine, L. H. Veronneau 942,474
Floor dressing machine, S. D. Hoy 942,830
Flower pot holder, C. H. Keitsch 942,177
Flue block mold, O. C. Hiatt 942,779
Flue cleaner, S. S. Poole 942,515
Fluid pressure engine, C. P. Ebersole 942,441
Folding box or crate, R. Hobenstein 942,642
Foot and leg rest, J. Flindall 942,630
Foot, artificial, J. F. Rowley 942,521
Foot power motor, W. Hargrove 942,556
Fore carriage, J. W. Gamble 942,319
Fruit picker, E. A. Ableman 942,302
Fuel composition and producing the same, L. R. Palmer 942,213
Fuel, economizing, Allen & Pyper 942,530
Furnace, M. Zippler, Sr. 942,872
Furnace door, G. de Grahl 942,822
Furnaces, gas analyzer for, Mailloux & Westover 942,861
Furrow opener, L. T. Rasmussen. .942,281 to 942,283
Fuse, automatic self indicating, F. B. Cook 942,248
Game apparatus, W. J. Rigney 942,103
Game apparatus, W. Stevenson 942,757
Game apparatus, base ball, J. W. E. Dean 942,619
Game board, F. G. Rempe 942,748
Game schedule, C. H. Lovell 942,178
Garbanson hulling and separating machine, Brockett & Garver 942,053
Garment, M. Lang 942,144
Garment, inner, J. W. Appleton 942,159
Garment supporter, D. H. Haywood 942,323
Gas burner, L. H. Brady 942,709
Gas burner, H. S. Humphrey 942,831
Gas, contrivance for saturating liquids with, F. Trosiener 942,115
Gas cut-off, safety, H. Tullis 942,601
Gas holders, low limit valve for, L. Shaw 942,796
Gas lighting and extinguishing apparatus, A. E. Broadberry 942,772
Gas lighting apparatus, G. E. Hulse 942,561
Gas mains, automatic cut-off for, C. E. Lahmers 942,832
Gas pressure regulator, O. Sprecher 942,112
Gas producer, O. K. Zwingenberger 942,361
Gas, retort for the manufacture of illuminating, C. W. Isbell 942,501, 942,858
Gas treating apparatus, D. C. McIntyre 942,863
Gate, W. D. Whitney 942,228
Gearing, H. M. Baker, Jr. 942,600
Gearing, Potter & Johnston 942,843
Gearing, double back, J. C. Pflanger 942,185
Gearing, transmission, C. B. Kurtz 942,266
Gearing, transmission, L. C. Norton 942,406
Gin saw cleaner, A. N. Tumlin 942,800
Glass articles, manufacture of, C. B. Lawton 942,651
Glass cutter, J. W. Tucker 942,152
Glass panes, metal frame for, A. Busse 942,611
Glass washing apparatus, C. W. Jaycox 942,074
Glove, swimming, C. Iverson 942,262
Gold, apparatus for washing out placer, S. Rachleman 942,663
Golf club, F. E. Rigden 942,353
Governor for internal-combustion engines, E. Higgins 942,071
Grader and scraper, road, S. Richardson 942,749
Grain cutter, L. Clark 942,614
Grass digger, quack, J. Honkins 942,559
Grid resistance, H. J. Wiegand 942,156
Grinding machine, portable, Dangiemeyer & Connors 942,311
Grinding mill, G. E. Sovereign 942,357
Grinding mill, J. Bercha 942,768
Grinding or pulverizing machine, A. H. Petersen 942,865
Gun, automatic, Dawson & Buckham 942,167
Guns, single trigger mechanism for double barrel, J. D. Russ 942,794
Hair cutting instrument, F. B. Walter 942,298
Hair supporter, J. Latsch 942,833
Hame, Price & Schenck 942,351
Hame fastening, J. H. Bankson 942,160
Hammer, drop, L. P. Blot 942,708
Hammer, pneumatic power, A. Berner 942,163
Hammer, power, Scott-King & Norris 942,756
Hammocks, etc., resilient bottom for couch, I. E. Palmer 942,841
Harmonic signaling system, R. H. Manson 942,091
Harrow, G. A. Olson 942,511
Harrow, alfalfa, E. F. Price 942,516
Harrow, drum, S. B. Clardy 942,376
Harrow tooth fastener, E. M. Rich 942,412
Harrows, connecting bar for, G. Anderson 942,532
Harvester, corn, J. W. From 942,820
Harvesting potatoes, onions, etc., apparatus for, Dunham & Peck 942,626
Hat guard, M. R. & M. J. Soden 942,678
Hat retaining and ventilating means, R. D. Baker 942,303
Hatchet, folding pocket, H. McNally 942,342
Head rest, F. Corkins 942,485
Heel counters, etc., machine for making skived blanks for, L. L. Hartwell 942,557
Hinge, D. Wilde 942,089
Hinge, J. Flindall 942,723
Hinge hanger, G. E. Leverton 942,784
Hoisting device, H. A. Myers 942,735
Horse power, meter for indicating, W. E. Burt 942,130
Horses' knees, dressing retainer and shield for, J. Douglas 942,624
Horseshoe making machine, R. S. Matteson 942,370
Hose or pipe coupling, C. B. Atkinson 942,047
Hose supporter and protector, combined, V. Robbins 942,751
Hot air furnace, W. Miller 942,655
Hub, variable speed coasting and braking, A. F. Rockwell 942,520
Humidifier, F. B. Comins 942,712
Hydrocarbon burner, J. A. Hunt 942,857
Ice cream freezer, A. E. Hopley 942,260
Igniting device, electric, J. A. & B. A. Jeffery 942,646
Indurated product and preparing same, L. H. Baekeland 942,852
Ink distributer for platen presses, A. R. Berreyesa 942,705
Inking apparatus, H. F. Bechman 942,703
Insect trap, R. Haselrigg 942,204
Insulating support for high-tension conductors, R. D. Mershon 942,335
Internal combustion engine, E. Higgins 942,070
Internal combustion engine, C. G. Wridgway 942,124
Internal combustion engine, C. G. Weld 942,227
Internal combustion engine, H. L. Jones 942,782
Iron heated by electricity, J. Collicott 942,308
Iron heater, portable, E. C. Thompson 942,422
Ironing table, folding, J. H. Hummer 942,643
Jack-screw, shifting, S. M. Dunlap 942,170
Jar and bottle closure, B. Hoffman 942,141
Jar holder, J. Twohig 942,602
Joint fastener, M. W. Wintermute 942,693
Journal bearing for removable disks, dust proof, P. Broman 942,539
Key fastener, P. J. Ryan 942,753
Keyhole plug and guard therefor, C. S. Batdorf 942,537
Knob, adjustable door, R. C. Walter 942,605
Label holder, E. J. Middleton 942,094
Ladder, J. Vaghi 942,683
Lamp, H. Salsbury 942,589
Lamp, E. E. Allbee 942,608
Lamp, flaming arc, Martin & Schreiner 942,730
Lamp holding device, plural, R. B. Benjamin 942,240, 942,242
Lamp, miner's, R. L. Graves 942,823
Lamp socket, plural, R. B. Benjamin 942,241
Lamps or headlights, mechanism for vehicle, A. P. Prendergast 942,217
Last, W. S. Hamm 942,554
Lathes, stop motion for veneer, J. M. Rounds 942,105
Laundried articles, carton or holder for, N. J. Goodman 942,201
Lavatory fitting, P. Mueller 942,385, 942,386
Leg fastening, G. W. Franzheim 942,380
Limbs, joint for artificial, F. W. Merrick 942,093
Line casting machine, J. R. Rogers 942,845
Line casting machine, F. B. Converse 942,848
Line casting machine, F. C. L. d'Aix, reissue 13,048
Liquid dispensing apparatus, H. S. Cornish 942,165
Lock indicator, Arens & Teich 942,806
Locomotive ash pan, T. W. Anderson 942,765
Locomotive ash pans, device for cleaning, N. Olson 942,737
Locomotives, etc., arch for fire boxes of, J. Loftus 942,575
Loom dobby, T. Haworth et al. 942,826
Loss preventing device, W. K. Wolf 942,695
Lubricating draper roller, J. D. Jones 942,728
Luggage carrier, T. W. Tschiffely 942,526
Mail bag handling apparatus, Pedersen & Christensen 942,278
Mail box support, A. P. Kersey 942,859
Mail catcher, railway, N. H. Campbell 942,055
Mail exchanging device, H. Diefenbaugh 942,717
Mail handling apparatus, railway, N. H. Campbell 942,055
Mail pouch catching and delivering apparatus, J. L. Ware 942,762
Mail pouch transferring apparatus, J. W. Pepple 942,214
Malt stirrer, M. Kondolf 942,649
Massage apparatus, J. W. Jones 942,206
Massage device, Wiking & Bengtsson 942,299
Match safe, C. E. Birky 942,706
Measurer, skirt, U. E. Morrison 942,338
Measuring appliance, angle, A. Konig 942,393
Measuring attachment for cloth folding machines, K. von Thigpen 942,685
Measuring machine, cloth, C. H. Lantz 942,684
Meat tenderer, W. H. Humeston 942,448
Metal, forming expanded, W. H. Cooley 942,309
Metal pieces, joining, H. Goldschmidt, reissue 13,050
Metal rods or bars, apparatus for use in twisting, Hartel & Kissling 942,322
Metallic tie, Emerley & Matschuk 942,721
Milk sampling and measuring device, A. A. Johnson 942,648
Milking cows, F. M. Berberich 942,243
Milking machine, L. Burrell 942,482
Milling machine, portable, R. P. Decker 942,168
Mines, conveyer for, P. J. Riley 942,750
Molding machine, S. F. Nicolai 942,457
Molding, machine for use in drawing patterns in, S. Strettles 942,419
Mop wringer, M. E. Davis 942,135
Motor controller, A. Kimble 942,382
Motor controlling apparatus, electric, H. E. Dey .... 942,196 to 942,198
Motor controlling device, T. E. Barnum 942,050
Motor starting device, internal combustion, E. L. Sharpneck 942,467
Motors, igniter for internal combustion, H. A. Johnston 942,328
Motors, method of and means for regulating the speed of electric, R. H. Rogers 942,463
Mowing machine, M. Jewell 942,075
Music holder and turner, H. M. Masters 942,399
Music leaf turner, R. A. Gibson 942,821
Music record sheets, apparatus for producing perforated, G. Machlet, Jr. 942,398
Musical instruments and other apparatus, contact device for self-playing, G. H. Davis 942,550
Musical instruments, water key for, W. W. Allen 942,429
Note sheets, receiving spool for, W. R. Crippen 942,548
Nut lock, W. H. Beitz 942,193
Nut lock, G. Bryar 942,194
Nut locking expansion bolt, Vernon & Morningstar 942,226
Optical illusion apparatus, E. P. Hoyt 942,569
Ore roasting pot, F. D. Baker 942,810
Ore treating furnace, H. C. Bellinger 942,052
Ores, securing the chloridization of, W. Koehler 942,569
Oven, gas range, W. J. Best 942,128
Ozone, generating and storing, F. M. Ashley 942,046
Packing pad, A. D. Alexander 942,101
Paper bags, machinery or apparatus for forming or making, J. Day et al. 942,715
Paper bottle, R. Landell 942,088
Paper making machines, beater roll for, Rankin & Dederick 942,746
Paper mills, treating the spent liquor of, I. Kitsee 942,207
Paving composition, J. H. Amies 942,237
Paving purposes, composition for, J. H. Amies 942,236
Pedal folding apparatus, F. C. White 942,359
Pencil holder, F. C. Reiter 942,747

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THE LIFE OF A SPLASH.

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attaining its greatest proportion, its walls begin to thicken, and gradually subside to form a mere ring of lobes on the surface, surrounding a central hollow.

Then comes a rebound, manifested in the rising of a central column which, after attaining its full height and subsiding, is followed by a secondary column ere the series of events which we term "the splash" is complete. Prof. Worthington shows that the separation in the form of a drop of the top of the primary column ere its complete subsidence results in a series of events markedly different from that which ensues when no separation takes place. Moreover, the manifestation of outspreading ripples is affected by the condition of the surface; and in order to secure the most favorable conditions by cleaning the surface, a continous slow stream of fresh water is maintained. The contamination of the surface liquid, by the way, originates in lamp black brought down by each drop; for in order to prevent the drop from adhering to the watch glass in which it rests prior to its fall, it is found necessary carefully to smoke the glass in the flame of a candle. But the atoms of lamp black which adhere to and are brought down with each drop serve to make clear some important points connected with the formation of the splash. They prove by their presence that the interior of the crater is lined by the original liquid which formed the drop, and thus afford useful information as to the nature of its flow. When the primary column commences its ascent, the atoms of lamp black are carried upward at its summit, proving that the liquid of the original drop emerges at the head of the central column. This is confirmed by allowing a drop of milk to fall into pure water, when the photograph shows that the upper part of the column contains nearly all of the milk. This fact may be easily verified by naked-eye observation, as indicated by Prof. Worthington. Let the reader drop from a spoon into a cup of tea or coffee, from a height of fifteen or sixteen inches, a single drop of milk. He will have no difficulty in observing that the column which emerges carries with it the white milk-drop at the top only slightly stained by the liquid into which it has fallen.

Upon increasing the height of the fall of a drop to about 40 inches, a new phenomenon is registered in the photographs. The crater rises to a greater height; but instead of subsiding in the form of a ring, its mouth closes to form a bubble on the surface of the liquid. If the height be not too great, the closing is either incomplete or at any rate only temporary, and the bubble reopens at the top to make way for the column which rises as before from the base, but is now much thicker and hardly so high as before. With a very high fall, however, the bubble becomes too firmly closed to reopen, and its summit is struck from within by the rising column, which becomes entangled in the liquid of the bubble when the latter bursts. Thanks, however, to the influence of surface tension, regularity of form is soon regained, so that the concluding events of a splash after a high fall agree in essentials with those which follow a low fall.

The facts elucidated by experiments with a sphere dropped from varying heights into liquid proved to be of great interest and importance. Prof. Worthington suggests that those who wish fully to grasp the significance of his photographs and deductions should experiment for themselves by dropping marbles from a height of about a foot into a deep bowl of water, the bottom of which should be protected from the possibility of breakage by a few folds of fine copper gauze. A perfectly clean and highly polished marble so dropped will enter the water almost noiselessly with very little disturbance of the surface. In a word, the splash is singularly insignificant. Photo-

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graphic records show that the liquid, instead of being driven away from the surface in the form of a crater (as is the case when a drop or a rough sphere strikes the surface) now rises in a thin, closely-fitting sheath which completely envelops the sphere even before its summit has reached the water level. A comparatively insignificant column constitutes the subsequent splash. Moreover, and as a result of the rapidly closing sheath, practically no air is carried into the water by the smooth sphere. This point, as well as many others of great importance, was shown photographically by means of illumination behind a thin glass vessel with parallel sides—an arrangement which rendered it possible to photograph the splash both above and below the surface of the fluid. Most of the photographs reproduced were taken in this way.

So much for the splash caused by a smooth sphere. If the reader will now fish out the marble with which he is conducting his simple experiments, roughen its surface with sandpaper, and again drop it from a height of a foot or so into the water, he will find that a totally different splash results. There is now a great noise of bubbles, which may be seen rising through the liquid, while a tall jet is seen to be tossed into the air. Photographic records of the surface disturbance closely resemble those which have already been described, caused by the fall of a drop. A crater is formed, and subsides, and a graceful jet rises from its depths, gathers volume from below, and rises ultimately as a tall column whose height may be even greater than that from which the sphere fell. Photographs of the descent of the sphere below the surface show us how this column originates. The sphere as it descends drags with it the surface film of the liquid in the form of a gradually deepening pocket or bag which ultimately forms a long cylindrical hollow. This eventually divides, and the lower part is dragged down by the sphere to the bottom (no matter what the depth), whence it rises to the surface as a bubble. Meanwhile, the upper half of the cylinder rapidly fills up; and this running together of the liquid is responsible for the great velocity of the upward-spurting jet or column.

On increasing the height of the fall of a rough sphere, a higher crater which closes and forms a bubble is obtained, just as when the height of fall of a liquid drop is increased. With a fall of two feet, this bubble is almost immediately destroyed by an upward jet. But if the height of fall be increased to four or five feet, no rebounding jet will be projected into the air, notwithstanding the fact that much air is still carried down by the roughened sphere. To the naked eye, a curious "seething" appearance at the surface is apparent; and Prof. Worthington admits that he was at first disposed to regard this as evidence of the entanglement of the jet with the bubble—an entanglement likely to produce confused motions which could not be profitably studied. However, the persistence with which the seething motion again and again returned when a stone was dropped or thrown into the river, led him to suspect that something required investigation. The remarkable change of procedure revealed in the series of photographs which was subsequently taken will be best described by a word for word quotation from Prof. Worthington's writings. "The earlier figures show the very rapid rise of the crater and its closing as a bubble, much before the entrapped column of air divides. Before the division takes place, the liquid now flowing in from all sides closes over the upper end of the long air tube, separates it from the air outside, and forms a downward jet which shoots down the middle of the air tube in pursuit of the sphere. The first formation of this jet is not easy to observe, because the view is obscured

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by much splashing and turbulent vortical motion resulting apparently from the streams that converge from all sides of the axis of the air tube at its upper end, . . . but (when) the turbulence has cleared away from the upper part, and from this stage onward the jet is well seen in all the figures, and it persists long after the segmentation of the air column has taken place. The reader must not suppose that this jet is a mere falling of the water under the action of gravity, for the rapidity with which it advances is far greater than could be accounted for in this way. . . . The great initial momentum of the sphere causes it to continue in rapid motion after the bubble has closed, thus the sphere acts as a sort of piston, which by increasing the length of the air tube diminishes the pressure in it and so sucks in the bubble, which is driven down by the greater atmospheric pressure above. The converging horizontal inflow near the mouth of the air tube cannot, of course, produce the downward-directed jet without an equal and opposite generation of momentum upward; but this is now expended, not in producing a similar upward jet, but in balancing the excess of atmospheric pressure. The reaction, in fact, to the projection of the jet downward is the force which holds up and slowly raises the roof of the long air shaft." The rising of the roof is well shown in some of the accompanying photographs.

Thus, as Prof. Worthington points out, the formation of a downward jet is not, in a sense, a new phenomenon, but one which, having existed unnoticed before, is now rendered visible by reason of its being produced in air instead of water. An increase in the height of fall to 22½ feet was found to produce but little change in the phenomena coincident to the resulting splash.

As an illustration of the possible application of knowledge gained from a study of splashes in an unexpected quarter, Prof. Worthington draws attention to the fact that photographs of the splash of a projectile on striking the steel armor plate of a battleship bear a close resemblance to photographs of splashes caused by a sphere falling into liquid. There is the same slight upheaval of the neighboring surface, the same crater, with the same curled lip, leading to the inference that under the immense and suddenly applied pressure the steel has behaved like a liquid. The professor suggests that from a study of the motions set up in a liquid in an analogous case, it may be possible to deduce information about the distribution of internal stress, which may apply also to a solid, and thus lead to improvements in the construction of a plate that is intended to resist penetration.

In conclusion it should be said that the number printed below each photograph here reproduced gives the time in decimal parts of a second which has elapsed since the first instant of contact.

CARNIVOROUS PLANTS OF THE FUTURE.

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edge of the leaf in certain species is seen to curl slowly inward. Now we can imagine that in the very far-away future with which we are dealing the Pinguicula will develop leaves which will hardly be less than five or six feet in length. These lying along the surface of the ground will make a special appeal to grazing animals. Perhaps as with the sundew the allurement will be in the form of some pleasant-tasting secretion which is peculiarly attractive to sheep and goats. We can imagine how these animals on first coming across the plants would start to regale themselves at the prepared feast. The strong sticky substances would take a firm hold of the hairs surrounding the mouth parts of the creatures, and in their endeavor to free themselves the animals would become more entangled. Gradually, too, the sides

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Pencil sharpener, A. Rydquist 942,107
Perforating and binding machines, assembly box for, C. F. McBee 942,180
Permutation lock, G. H. Hamilton 942,553
Phenol and formaldehyde and making the same, condensation product of, L. H. Baekeland 942,706
Phenol and formaldehyde, making insoluble products of, L. H. Baekeland 942,069
Phonic apparatus, T. H. Macdonald 942,080
Phonograph, P. Weber 942,475
Picture mount, movable, H. O. Sauer 942,565
Pile, W. N. Louque 942,653
Pipe and rod threader, H. Gautschi 942,200
Pipe fitting, soil, F. B. Morton 942,329
Pipe or rod carrier, G. Holt 942,446
Pipe, skelp treating apparatus for lapweld, H. W. Hock 942,176
Pipes, air vessel for water supply, K. Romstaedt 942,666
Pipes, lining, J. O. Persons 942,184
Pipes with sand, apparatus for filling metal, C. O. Scholz 942,355
Piston for hot-air engines, F. B. Hubbard 942,201
Planter, Trammell & Hammack 942,760
Planter and fertilizer distributer, combined seed, E. P. & J. T. Patterson 942,792
Planter and marker, corn, A. W. Koage 942,394
Planter, see, Fowler & Daly 942,495
Plastic material, machine for forming, G. S. & P. H. A. Balsley 942,238
Plate dishing and flanging machine, C. Gabriel 942,062
Plated metal and making the same, J. Wilder 942,803
Pliers, H. F. Keilemen 942,504
Pliers, W. Cronk 942,549
Plow, J. T. Gantt 942,849
Pole sleeve, C. B. Voynow 942,761
Post. See Fence post.
Post office box, H. O. Haywood 942,203
Power device, W. H. H. Baker 942,534
Power generating apparatus, C. J. Lake 942,873
Press for expressing fluids from solids, F. G. Wiselogel 942,301
Pressure generating and applying apparatus, hydraulic, J. W. Nelson 942,736
Pressure regulator, G. W. Collis 942,546
Printing apparatus, frame structure for blue, R. Herman 942,175
Printing machinery, J. A. J. Hayes, reissue 13,051
Printing press paper feed mechanism, J. E. Tucker 942,296
Printing press rotary folder, W. H. De Bush 942,136
Printing press, throw-off mechanism for the inking rolls of rotary, L. A. Wheat 942,119
Program holder, detachable leaf, F. E. Sauerwein et al 942,670
Program holder, transparent theater, F. E. Sauerwein et al 942,669
Projectiles, attachment for, C. Davis 942,617
Propelling means, vessel, F. Fanning 942,190
Protractor and level, N. R. Thibert 942,114
Pulling over machine, H. Walther 942,155
Pulverizing machine, E. E. Wann 942,424
Pump, C. F. Preslar 942,145
Pump mechanism, M. B. Van Ness 942,207
Punch and shear, C. Peterson 942,409
Punching machine, hand, H. Siegrist 942,291
Punching machine, multiple, C. E. Macbeth 942,272
Puzzle, W. F. Bartsch 942,536
Quoin, E. J. Casey 942,543
Rack, McGregor & Rudland 942,580
Radiators, pressing device for push nipple, H. L. E. Peterson 942,410
Rail clamp, D. S. Wert 942,427
Rail controlling device, switch, W. F. Doner 942,313
Rail joint, M. Barschall 942,127
Rail joint, W. E. Ransom 942,411
Rail joint, W. P. Perkins 942,662
Railway block signaling system, J. Gassper 942,255
Railway carriage doors, appliance for automatically and otherwise locking and unlocking, Andrews & Bickerton 942,125
Railway-crossing, I. O. Staut 942,358
Railway crossing, W. C. Peters 942,740
Railway gate, E. L. Kishpaugh 942,783
Railway rail spike and chair, J. T. Nulty 942,658
Railway signaling system, automatic, G. H. Sloane 942,468
Railway spike, R. L. Smith 942,608
Railway switch, J. F. Ober 942,458
Railway switch, automatic, Rexach y Torres & Pena y Martines 942,600
Railway tie, H. C. Krepps 942,650
Railway tie, H. H. Ranje 942,745
Railway tie, metal reinforced, J. F. Lahart. 942,267, 942,268
Railway tie, self-adjusting steel, A. J. Schneider 942,754
Railway ties, etc., composition for, J. Kirkham 942,505
Railway track safety block, L. F. Learman 942,835
Railways, catenary suspension system for the trolley wires of electric, K. von Kando 942,143
Razor case, W. L. Clark 942,484
Reamer, adjustable, R. W. Bailey 942,533
Receptacle closure, fluid, A. & T. A. De Vilbiss, reissue 13,049
Reclining chair, J. Flindall 942,818
Rectal apparatus, J. P. Sanborn 942,590
Record tablet, G. A. Eliason 942,627
Refrigerating apparatus, J. Heinrich, 942,445, 942,499
Refrigerating machine, R. N. Dyer 942,307
Refrigerating package, A. W. Folsom 942,318
Registering device, R. Hunter, reissue 13,052
Relay, S. D. Field 942,815
Rivet feeding device, J. E. Peters 942,864
Riveting machine, C. Greiner 942,637
Road working machine, M. A. Popkess 942,806
Roasting pan, P. Scott, reissue 13,054
Rock elimination, apparatus for waste, H. L. Kramer 942,083
Rolling mill transfer table, C. L. Huston 942,344
Roof ventilator, W. W. Birnstock 942,707
Roofing package, F. C. Overbury 942,060
Rotary engine, H. Roux 942,413
Rotary engine, W. W. Wheeler 942,376
Rotary motor and pump, J. R. Kinney 942,630
Rotary steam engine, J. W. Johnson 942,205
Rotary steam engine, W. E. Minue 942,275
Rule, Jewell & Westcott 942,327
Rule, W. L. Neeld 942,583
Running gear, A. T. Newell 942,182
Sand and slime separator and classifier, C. Allen 942,607
Sanitary ware, J. J. Cosgrove 942,547
Sapphires and other precious stones, machine for cupping, J. L. Wennstrom 942,425
Sash holder and lock, K. F. Deskins 942,716
Sash holding device, O. M. Edwards 942,720
Saw setting machine, A. C. Ambler 942,531
Saw setting tool, J. L'hote 942,573
Saw wheel, band, C. A. Putnam 942,588
Scaffold, S. Pichler 942,347
Scale, ice box and refrigerator, D. G. & A. H. Sansbury 942,286
Scarf pin safety attachment, F. S. Reynolds 942,517
Screens, fly attachment for, E. White 942,120
Screw cutting machine, R. C. Nugent 942,791
Screw driver, B. Presson 942,742
Screw driver and tweezers, combined, Bjorn & Cashmore 942,373
Screw driver, spiral, J. A. Leland 942,571
Screw, set, A. Levedahl 942,506
Seal and spout for cans and other receptacles, H. A. Truesdale 942,847
Seal, metallic, W. E. Elliott 942,315, 942,316
Seal, snap, E. J. Brooks 942,774
Seal, tag attaching, E. J. Brooks 942,433
Seals, packing and registering, W. B. Elliott 942,317
Sealing box fasteners, tool for, R. Schleicher 942,673
Seam dampening machine, turn down collar, W. A. Zeidler 942,233
Seeder, C. W. Stark 942,868
Sewing machine, W. A. Mack 942,090
Sewing machine gage, N. Friedman 942,496
Sewing machine holder, combination, Walker & Parrish 942,802
Shade bracket, window, C. W. Brown 942,775
Shade holder, W. A. Painter 942,738
Shaft, pneumatically operated, P. J. Grebel 942,065
Sharpener for lawn mowers, E. Merritt 942,578
Sharpener, knife, M. L. Hawks 942,172
Sharpening device, razor, J. J. Meehan 942,731
Shaving appliance case, W. L. Clark 942,483

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of the huge leaves would close inward, and the fate of the victim could not long be delayed. A pitiable spectacle indeed to see these animals done to death by a plant, but the same process on a smaller scale is repeated thousands of times during the summer in any place where the Pinguiculas abound.

We can hardly think in this advance of vegetable life that the many species of pitcher plants which catch their prey more by allurement than by force, would be behindhand in the forward movement. Even at the present time many of these species develop processes which are several feet in length, as exemplified in the case of the Sarracenias and Darlingtonias. In one of the accompanying illustrations is pictured one of the colossal pitchers which in the course of ages may be evolved from the comparatively small Cephalotus—a native of Australia. There is no knowing what inducements these plants might not be able to hold out for the capturing of even man himself. Perhaps the tissue inside the pitcher would be peculiarly succulent, and we know that where there is anything worth having, there will always be found men daring enough to take the risk of getting it. Once inside the pitcher of the Cephalotus, escape would be possible only with a friendly assistant at hand. From the bottom of the pitcher three barriers would confront the prisoner anxious to get out. First of all there is a circular ridge projecting in such a way that it is most difficult to surmount. Secondly a stretch of wall thickly covered with processes resembling the teeth of a comb and all pointing downward. Last of all, on the involute rim round the mouth of the pitcher is arranged a fringe of decurved spines which resemble a row of formidable bayonets. Indeed, it would be a far more simple matter to get out of the average well than to make one's escape from a giant Cephalotus pitcher.

Although the matter does not involve death, the giant Aristolochia flower brings about the imprisonment of flies for quite a long time. The system is in connection with the cross-fertilization of the blossom. The insects are induced to enter the cavernous mouth of the great bloom by an odor strongly suggestive of carrion, which is peculiarly attractive to flies. Once inside, the flies are held captive by an ingenious arrangement whereby they are lost in the tortuous passages at the rear of the flower. After blundering around for some time the winged creatures are able to emerge again, not, however, before they have become well dusted with pollen for transmission to another bloom. It is possible that the Aristolochia of years to come will assume much larger proportions, and we may imagine that the flower will be able to hold out some allurement which will tempt large animals to enter its gloomy depths. It is more likely that escape from the colossal blossom would not be such a simple matter, and there might be a danger of a creature's coming unpleasantly near to starvation before seeing daylight again.

Far more dreadful than any of the plants described above would be the Venus fly trap of the future. This plant would be a vegetable terror. As is well known, the leaves of this plant are designed in the form of a trap. On the upper surface of each half of the leaf are three hairs. To touch any of them is to cause the organ to shut up, inclosing the object which has given rise to the irritation. The bordering of the leaf is formed of sharp fringed hairs which when the trap is closed prevent escape. At the most the leaves of the Dionæa are not more than an inch in length, but we may get a little idea of what this plant may be in years to come if we imagine the foliage to be large enough to grapple with a man. It is the habit of this plant to grow with its leaves half concealed beneath the sphagnum moss in which it thrives. The leaves of the giant man trap partly hidden by the undergrowth would form the

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Sheet feeding machine, H. K. King 942,078
Sheet metal plates, cutting disks from, D. P. Robinson 942,104
Sheet registering mechanism, H. K. King... 942,079
Shingle and making the same, metallic, Lunan & Rantsch 942,577
Shingle stamp and packer's recorder, automatic, G. A. Ortwein 942,512
Shoe nailing machine, V. Sandahl 942,591
Shuttle operating mechanism, C. F. Arnold. 942,698
Shuttle threading device, J. Jordan 942,263
Sign manufacture, triple, T. P. Heinemann. 942,498
Signal controlling apparatus, W. M. Chapman 942,195
Signaling device, mechanical code, F. A. Meissner 942,334
Signaling system, F. E. Smith 942,676
Silo, G. Moeke 942,095
Silo, J. H. McCoy 942,340
Silo, Harrison & Jacoby 942,640
Sinker, G. W. Teasdale 942,597
Sintering apparatus, R. Palmer 942,513
Skate, roller, W. Lennox 942,333
Skate, roller, J. Nuttall 942,344
Skirt hanger and stretcher, W. J. Tetreault. 942,525
Skirt marker, S. E. C. Campbell 942,375
Sliding gate, J. M. Peterman 942,408
Smoke preventer, time controlled, B. L. Ames 942,131
Smoke washer, J. Altenhofen 942,430
Smoking pipe, E. B. Whitney 942,688
Snap, breast strap, W. Sedlacek 942,289
Snatch block, E. Martin 942,274
Snow melter, C. L. Moore 942,337
Soap, antiseptic, W. A. Beatty 942,538
Sock and garter, combined, L. O. Gitchell.. 942,552
Socks, excluder for elastic, F. W. Savage.. 942,671
Solder to rims of caps for cans, machine for applying, R. Flanigan 942,494
Soldering furnace, E. T. Burgess 942,245
Sole pressing pad, H. A. Davenport 942,133
Solitaire board, F. E. S. Smith 942,667
Spade or shovel blade, H. Dahlmann 942,616
Spear, punch, and bending machine, combined, S. Takacs 942,680
Speed changing mechanism, E. H. R. Barton 942,192
Speed measuring machine, Comstock & Kalmus 942,132
Speed mechanism, variable, A. F. Rockwell. 942,220
Speed varying mechanism, A. C. Smith 942,416
Speedometer, W. R. Harris 942,497
Spike puller, W. F. Scott 942,415
Spinning and like machinery, thread guide for cotton, J. & E. Appleby 942,362
Spinning mules, reversing mechanism for the band cylinders of, J. H. Ryalls 942,752
Spinning spindle, J. V. Cunniff 942,777
Spring wheel, A. Moore 942,276
Stamp affixing machine, J. F. Monaghan... 942,454
Stamps, reversible ribbon feed for dating, B. B. Hill 942,827
Stanchion, F. G. & A. E. Harris 942,639
Stave jointing machine, N. M. Taylor 942,799
Steel holding and packing means, drill, D. S. Waugh 942,869
Stirrup, safety, W. V. Johnston 942,781
Stock releaser, Lemon & Stoops 942,875
Stoker, mechanical, T. V. Elliott 942,060
Storage battery, D. P. Perry 942,279
Stove, heating, H. F. Arenberg 942,805
Strainer, M. C. White 942,121
Strainer, liquid, F. L. Williams 942,428
Street and road construction, preparing mineral materials and the like for, J. H. Amies 942,235
Supplemental seat, A. Reineke 942,793
Support and insulator, E. F. Lindsay 942,086
Supports, adjusting device for, P. Colidge... 942,545
Switch signaling and operating mechanism, W. R. Oyler 942,099
Swivel hook, C. G. Theiling 942,681
Syringe, irrigating, W. S. Sawyer 942,523
Table. See Ironing table.
Table attachment, J. A. Chow 942,613
Tack, window shade, L. B. Girard 942,321
Talking machine sound box, A. Fischer 942,816
Target practice apparatus, H. H. Cummings 942,615
Telegraph, automatic, L. M. Potts 942,844
Telegraph, multiplex, S. D. Field 942,814
Telegraphic repeating apparatus, W. E. Athearn 942,807
Telegraphy, duplex cable, I. Kitsee 942,208
Telegraphy, electric, J. A. L. Dearlove 942,620
Telephone, portable, O. L. Mulot 942,401
Telephone systems, signaling apparatus for, R. C. Welty 942,703
Telescopic article, W. J. Dunn 942,490
Thermostat, J. F. Williams 942,870
Thread board, W. O. Aldrich 942,607
Threshing machine, garbanzon, F. Garver... 942,063
Tie and means for fastening rails thereon, I. C. Catton 942,438
Tie plate and rail anticreeper, combined, M. S. Clarke 942,307
Tilling machine, G. Spalding 942,469
Tire, B. F. Norcross 942,097
Tire, J. C. Taylor 942,149
Tire, W. R. & T. S. Stewart 942,418
Tire, J. G. Maxwell 942,654
Tire, automobile, I. B. Kempshall 942,567
Tire for vehicle wheels, cushion, J. H. Poole 942,842
Tire, pneumatic, P. G. Muenchinger 942,734
Tire protector, F. Vacher 942,682
Tire, vehicle wheel, J. A. Boyajean 942,364
Tires, metallic protector for pneumatic, E. A. Hultberg 942,500
Tobacco, aging and curing, S. G. Martin et al 942,838
Tobacco cutting machine, Beall & Parker... 942,372
Tomatoes, treating, O. Schroen 942,287
Tongue switch, Strong & McPherson 942,295
Tool, D. C. Southworth 942,293
Tool handle, E. Kener, Jr 942,077
Tools, feed for pneumatic, M. Hardsocg.... 942,066
Towing device, C. W. Larson 942,450
Toy derrick, M. T. C. Wing 942,229
Toy, sounding, J. Berg 942,162
Toy, sounding, W. Bartholomae 942,610
Track sander, P. J. Coady 942,377
Track sander, A. W. Ham 942,726
Traction coupling, M. Westra 942,764
Train stop, automatic, W. J. Soseene 942,189
Tramway, aerial, H. S. Robinson 942,518
Tramway switch, N. Schwarz 942,288
Transfer hanger, T. E. & E. Hudson 942,326
Transferring material from a high to a lower level, apparatus for, A. C. Johnston.... 942,449
Transportation system, W. C. Carr 942,437
Trap, G. W. Hess 942,069
Trolley wheel, H. L. Baylies 942,767
Trousers support, J. V. Backlund 942,126
Truck, C. J. Ingard 942,563
Truck, car, J. C. Barber 942,048, 942,702
Truck elevator, inclined, . W. Reno 942,352
Truck, railway car, C. F. Murray 942,096
Tube cleaner, rotary, P. J. Darlington 942,312
Turbine, S. T. Holly 942,829
Turbine regulator, S. T. Holly 942,828
Turpentine cup, E. A. McKoy 942,210, 942,211
Turpentine gathering apparatus, E. A. McKoy 942,212
Type bar and typographic form, F. H. Richards 942,102
Type casting and composing machine, O. V. Sigurdsson 942,846
Typewriter, L. Hauerstein 942,825
Typewriting attachment, W. M. Deeter 942,366
Typewriting machine, A. G. Snyder 942,109
Typewriting machine, A. W. Steiger 942,113
Typewriting machine, J. Feibel 942,137
Typewriting machine, E. E. Barney 942,535
Typewriting machine, H. Crutchley 942,776
Typewriting machine, J. H. Barr 942,583
Typewriting machine clamp, E. E. Barney.. 942,049
Typewriting machine ribbon reversing mechanism, automatic, G. M. Kitzmiller 942,383
Universal joint, W. C. Lipe 942,087
Vacuum cleaning systems, handpiece for, C. R. Green 942,139
Valve, F. M. Ashley 942,045
Valve, F. N. Whitesell 942,122
Valve, C. F. Fernald 942,492
Valve, W. N. Long 942,576
Valve, T. P. Lavigne 942,834
Valve, dry, F. A. Phelps 942,100
Valve for engines, O. Pearson 942,587

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most terrible pitfall that the world has ever seen. Any unfortunate man who should chance to stumble into one of these leaves would be speedily crushed to death by the steady pressure of the inclosing sides. One can imagine that a country in which the man trap abounded would be avoided as much as a district inhabited by man-eating savages.

The aquatic plants such as the bladderworts (Utricularia) would scarcely be behindhand in this forward movement among the carnivorous species. These plants capture small water creatures by means of little bladders which are attached to their stems. The entrance to these receptacles is guarded by a little door, which can be opened easily from the exterior but may not be pushed aside from the interior. At the present time the bladders of the Utricularia are small, but there is no reason to suppose that they will always remain so. It is quite likely that they may increase in size so that they are able to grapple with good-sized fish and other water animals.

In these far-away days of which we have been speculating, plants will be divided into wild and tame sorts in the very real sense of the words. The botanical gardens of the time will be far more exciting than are the zoological collections of to-day. It is fortunate that all natural changes come about with great slowness, and it may be that the condition of man himself will have changed considerably by the time he is called upon to face these aggressive plants. It is to be hoped that this may be so, otherwise the outlook for the human race is distinctly disquieting.

A New Substitute for Cotton.

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German East Africa, and the exports thence to Germany are steadily increasing. So far, little attention has been given to cocoanut fiber and the fiber of the many palms growing in the protectorates has been allowed to run to waste. With a view to becoming independent of foreign countries for her supplies of this fiber, Germany is also going to see what can be done with the product of her own colonies. The whole aim of the German is to become "independent" and, as far as possible, do without foreign goods and foreign labor. Other instances could be given of this, were they not quite outside the scope of the present article.

POWER-DRIVEN SCOOTER.

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wheel clear of the ice when the engine is being started. This is accomplished by a lever of ⅜ x 1-inch iron placed and bent as shown in Fig. 1. When starting the motor the lever is pulled back and a small wedge of wood is slipped between it and the engine bed. After the motor has got going nicely it is slowed down and the lever gently relaxed, allowing the teeth to take a slight hold. As the craft gathers headway increase the power and also the pressure on the spikes until the lever is slack and the motor running at its maximum power. To stop, slow down and raise the wheel off the ice.

The construction of the rudder is simple. The stock is of ¾-inch iron 12 inches long. An 18-inch tiller of forged iron is pinned to the post with a ¼-inch pin. The stock is recessed and pinned to the iron yoke which carries the runner. This yoke is forged out of 1¼-inch iron and has a collar slipped over its shoulder to wear against another collar or flange fastened to the bottom to act as a bearing. A ½-inch pin secures the yoke to the runner. The runner blade is of ⅞-inch oak 1 foot 7 inches long and 2¼ inches high.

For the shoe use a piece of soft iron ⅝ inch deep and ⅞ inch wide cut to a V edge at an angle of 45 degrees on each side. The shoe should have a rocker of about ⅛ inch for the 13½ inches it is supposed to bear on the ice. It should have 8 inches bearing forward of the rudder pin and 5½ aft. The shoe is held to the runner by three ⅜ through bolts riveted and smoothed off. A guard is placed under the boat to prevent the runner from catching in obstructions.

The engine can now be installed. For a foundation use two 1¼-inch oak stringers running along four frames and shaped and spaced as per requirements of engine used. The stringers should be through bolted from the outside of planking to top of the bed and drawn up tight and solid.

Now set the motor in its bed and fasten down with ½-inch lag screws 3 inches long. The exhaust is piped over the side and the water and gasoline tanks are situated on the forward deck. They each hold 3 gallons, and should be made out of 18-ounce copper. The piping is led down through the mast hole along the floor to the motor. It should be of copper tubing, ¾ inch for the gasoline and 1⅝ inch for the water.

The batteries and coil are placed just under the tanks. Six dry cells are sufficient. In order to have the scooter trim with one person on the seat it will be necessary to put about 60 pounds of lead up forward as shown. As the keels of these boats are rockered, attention must be paid to this or else the pressure on the rudder will be too great or it will be lifted clear.

A ½-inch heavy motor cycle roller chain should stand the strain with care; but as to the diameter of sprockets experiments would have to determine this, as it would vary for every type of motor. With the driving wheel turning up 700 revolutions per minute the scooter would be going about 33 miles per hour. If the motor could turn up to that or over, it would be better to let it run up and gear it down.

With a motor of six or seven horsepower and turning 700 to 800 per minute I would use for a starter an 8-inch sprocket on the driver and a 7-inch one on the engine.

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Valve for steam traps, B. L. & G. H. Clover 942,246
Valve for train brakes, engineer's, W. K. Rankin 942,280
Valve grinder, I. C. Smith 942,222
Valve, pressure retaining, R. W. Kelly 942,351
Valve, quick action triple, D. S. Gilbert 942,654
Valve, regulating, T. M. Wilkins 942,309
Valve, safety gas, Yockey & McLeod 942,158
Valve, silcock and other, F. W. Carlson 942,541
Valve, throttle, Z. Paul 942,345
Valves, making records for setting slide, J. B. Michael 942,453
Vault vestibule, J. G. Giesting 942,633
Vehicle, A. F. Rockwell 942,219
Vehicle seats, shifting rail for, A. E. Smith 942,292
Vending apparatus, coin controlled, M. J. Forth 942,253
Vending machine, F. M. Weber 942,117
Vending machine, cigar, L. A. Vandiver 942,527
Vending machine, stamp, J. R. Armington 942,766
Veneer tapping machine, Nystrom & Taxon. 942,277
Ventilator. See Car ventilator.
Vessels, controlling device for filling, G. Schollmeyer 942,755
Vessels, towing arrangement for canal and river, E. O. Nikel 942,510
Vibrator, A. J. Stecker 942,596
Waistband for garments, adjustable, M. S. Erlanger 942,628
Warning signal and stopping device for the safe movement of public conveyances, W. Whitmah 942,388
Warp balling machine, W. G. Denn 942,813
Warp carriage, H. D. Colman 942,247
Washboard, D. C. Juleson 942,076
Washing machine, Ramthun & Gutekunst 942,664
Washing machine, J. Szava 942,758
Water closet, H. S. Rumsey 942,464
Water gage, R. H. Buckner 942,365
Water gate, J. H. Phipps 942,469
Water tube boiler, J. P. Sneddon 942,797
Water wheel, J. L. Bell 942,811
Weed cutter and cultivator, M. Pruyn 942,744
Welding device, foot power, Garver & Bissell 942,444
Well tube cutter, J. F. Baker 942,701
Wells, trip wall packet for oil, W. Palm 942,739
Wheel, Foss & White 942,819
Wheel block, A. J. A. Bennett 942,161
Wheel, pulley, and the like, P. Montupet 942,469
Wheel scraper, C. W. Stark 942,471
Whiffletree hook, R. F. Bloom 942,431
Whip lock J. W. Robertson 942,285
Winding indicator, O. Ohlson 942,659
Window cleaning apparatus, C. E. Prickett. 942,743
Window grate, adjustable, S. Jablonovsky 942,502
Window lock and lift, R. T. Axe 942,851
Window, metallic, T. Lee 942,289
Wire bender, L. D. Danforth 942,440
Wire twister, I. N. Morford 942,732
Wire tying machine, automatic, O. L. Bowers 942,305
Wire wall pocket, T. V. Cromwell 942,714
Wire winding machines, notching means for, W. L. Wergin 942,118
Woods, treatment of coniferous, W. H. Rowley 942,106
Woodworking machines, pressure device for, C. G. Wilderson 942,894
Wrapping machine, A. M. Price 942,101
Wrapping machine, package, F. Giroud 942,636
Wrought articles, making, J. H. Dods 942,489

A printed copy of the specification and drawing of any patent in the foregoing list, or any patent in print issued since 1863, will be furnished from this office for 10 cents, provided the name and number of the patent desired and the date be given. Address Munn & Co., Inc., 361 Broadway, New York.

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